

Energy Storage System

SUNSYS HES L Marine Package



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1. INTRODUCTION

1.1. Glossary

For the purpose of this document, the following abbreviations are used:

BESS:	Battery Energy Storage System
BMS:	Battery Management System
C-Cab:	Conversion cabinet (SUNSYS C-Cab L Marine)
C-Cab Master:	First cabinet of 2 or more paralleled cabinets
C-Cab Extension:	Cabinet in parallel with C-Cab Master
EMC:	Electro Magnetic Compatibility
EMS:	Energy Management System
ESS:	Energy Storage System
HMI:	Human Machine Interface
IM:	Islanding Mode
IoT:	Internet of Things (internet-connected devices)
PCS:	Power Conversion System
PE:	Protective Earth
PMS:	Power Management System
RCD:	Residual current device
SOC:	State of Charge
SOH:	State of Health
SPD:	Surge Protection Device
THDI:	Total Harmonic Distortion of Current
THDV:	Total Harmonic Distortion of Voltage

1.2. Concerned products

The present manual covers the SUNSYS HES L Marine range.

SUNSYS HES L Marine System is composed of an assembly up to 4 types of cabinets:

C-Cab

- Bidirectional power converter
- 100 to 200 kVA / cabinet. Based on 50kVA power modules.
- Automation functions
- AC/DC distribution and protection
- Battery management system
- IoT connected cabinet
- Possible to put up to 2 units in parallel per system to reach 400 kVA

B-Cab

- Lithium-ion battery
- LFP technology
- 186 kWh nameplate / rack - 176 kWh useable / rack
- Liquid cooling thermal management
- Integrated fire safety detection and extinguishing system included
- Possible to put up to 9 units in parallel per system to reach 1674 kWh nameplate / 1584 kWh useable

SUNSYS HES L Marine Configurations

SUNSYS HES L Marine system is available with different combinations of power and energy.

2. IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS– This manual contains important instructions for SUNSYS HES L Marine systems (see “Concerned products”) that shall be followed during installation and maintenance of the storage inverter.

A potential **Shock and Injury Hazard** exists when working on or around electrical systems which could lead to serious injury or even death. Only qualified competent personnel who have been trained in and are familiar with the **Risk of Electric Shock** and **Plasma Arc Flash Hazards** may perform installation and maintenance on electrical systems. It is the sole **responsibility of the personnel** doing the work to be fully cognizant of all necessary safety regulations and procedures and **be familiar with the installation instructions detailed in this manual.**

	CAUTION! Any work carried out on the equipment must be performed by skilled, qualified technicians.
	CAUTION! Each power supply line must be provided with overcurrent protection according to the indication contained in the present manual.
	Overcurrent protection for the AC circuit is to be provided by the installer.
	Before carrying out any operations read this user manual and its safety instructions carefully, in order to work under safe conditions.
	If the Battery Energy Storage System (BESS) is not supplied by SOCOMEC, overcurrent protection for the BESS is to be provided by the installer.
	CAUTION! Before carrying out any operations on the unit read the installation and operating manual carefully. Keep this manual safe for future reference.
	DANGER! Failure to observe safety standards could result in fatal accidents or serious injury, and damage equipment or the environment.
	CAUTION! If the unit is found to be damaged externally or internally, or any of the accessories are damaged or missing, contact SOCOMEC. Do not operate the unit if it has suffered a violent mechanical shock of any kind.
	CAUTION! Install the unit in accordance with the minimum distances from near walls in order to guarantee sufficient ventilation and access to handling devices (see Environmental requirements chapter).
	CAUTION! Only use accessories recommended or sold by the manufacturer.
	CAUTION! When the equipment is transferred from a cold to a warm place wait before operating the unit to avoid condensation.
	DANGER! LIVE DEVICE! RISK OF ELECTRIC SHOCK: Up to five separately fused voltage supplies can be connected to the unit: 1. DC line – supply from the batteries or other DC sources 2. AC line – supply to/from the grid and/or loads 3. AC line – auxiliary voltage supply (3 phases) 4. AC line – auxiliary voltage supply (1 phase) 5. AC line – auxiliary voltage supply from internal UPS (1 phase)
	DANGER! RISK OF ELECTRIC SHOCK! If the C-Cab is provided with internal UPS, switch off the UPS before maintenance. The input switches do not switch off the power coming from internal UPS. See the dedicated chapter for details.

	CAUTION! Before cleaning, performing maintenance work or connecting appliances to the unit, switch the unit off and disconnect all power sources.
	DANGER! Live device! RISK OF ELECTRIC SHOCK! - Carry out the following steps before C-Cab maintenance: - Disconnect the batteries - Disconnect the AC power supplies - Disconnect the DC disconnection switches (Q2) - Disconnect the AC disconnection switches (Q1 and Q3) - Switch off the UPS - Make sure the system cannot be restarted - Make sure the power supply (AC and DC voltages) has been disconnected
	DANGER! RISK OF ELECTRIC SHOCK! After disconnecting all power sources wait approx. 5 minutes for the complete discharge of the unit.
	CAUTION! RISK OF BURNS! During operation the casing of the heaters located in the bottom of the machine can reach high temperatures. Do not touch the surfaces!
	CAUTION! The tightening torque for DC and AC terminals must be in accordance with the indication of the present manual.
	CAUTION! Any use other than the specified purpose will be considered improper. The manufacturer/supplier shall not be held responsible for damage resulting from this. Risk and responsibility lie with the system manager.
	WARNING! The unit must operate within the ambient temperature range specified. Refer to relevant sections of this manual for limits and additional notes. The unit is not intended to operate at ambient temperatures higher than 40°C (104°F) or lower than -20°C (-4°F).
	NOTICE The maximum operating currents in controlled busbars or conductors are limited by the settings of the power control system (PCS) and may be lower than the sum of the currents of the connected controlled power sources.
	WARNING! Only qualified personnel shall be permitted to set or change the setting of the maximum operating current of the PCS. The maximum PCS operating current setting shall not exceed the busbar rating or conductor ampacity of any PCS controlled busbar or conductor.
	NOTICE For supplemental power control system: "This system is equipped with a power control system. All power control systems controlled busbars or conductors shall be protected with suitably rated overcurrent devices appropriately sized for the busbar rating or conductor ampacity".
	WARNING Configuration of power control settings system or changes to settings shall be made by qualified personnel only. Incorrect configuration or setting of the C-Cab may result in unsafe conditions.

2.1. Symbols Used on the equipment labels and plates

The words "CAUTION", "WARNING" or "DANGER" are used for cautionary marking.

Symbols	Description
	General warning – Important safety information.
	Risk of Electric Shock and/or ARC Flash Hazard: Life threatening voltages may be present with the risk of ARC Flash in the event of an inadvertent short circuit.
	Risk of explosion! Avoid short circuits!
	The switch is ON
	The switch is OFF
	Waiting time before operating
 	Protective earth terminal.
	Authorised personnel only.
	No smoking.
	Read the user instructions carefully. Read the user manual before performing any operations.
	Wear protective gloves.
	Wear safety shoes.
	Wear protective goggles.
	In the event of contact with the eyes, wash immediately with plenty of water and call a doctor. Call a doctor immediately in the event of accidents or illness.
	Do not dispose of in normal waste stream (symbol waste electrical and electronic equipment).

2.2. Important safety instructions for batteries

	Warning! a battery can present a risk of electrical shock and burn from high short-circuit current. Observe proper precautions.
	When replacing batteries use only batteries approved by Socomec. Do not connect the C-Cab to batteries that are not approved; this may cause serious damage to the equipment. For any further information, contact Socomec.
	Proper disposal of batteries is required. Refer to your local codes for disposal requirements.
	The characteristics of the batteries must be compatible with the ratings of the C-Cab. For any further information, contact Socomec.

2.3. Limits to use of this equipment

	This equipment is rated for permanent connection to an electrical low voltage power supply according to the ratings reported in the present manual.
	Devices and connections to the ancillary inputs and outputs (other than to external power) have specific limits with regard to voltages and isolation requirement; refer to relevant sections of this manual for limits and additional note.
	Any use other than the specified purpose will be considered improper. The manufacturer/supplier shall not be held responsible for damage resulting from this. Risk and responsibility lie with the system manager.
	Utility interconnection may require approval from the authority having jurisdiction in the local area.

2.4. Cybersecurity recommendations and best practices

Like any device connected to an Ethernet network, SUNSYS HES L Marine system must be protected against any risk of cyber-attack or loss/destruction of data.

SUNSYS HES L Marine provides cybersecurity features to prevent these attacks and help users implement and ensure the most robust IT protection possible. The following paragraphs set out some recommendations. Check that they are part of your company's security policy:

- Awareness of security policy: Users of SUNSYS HES L Marine must be made aware of appropriate IT security practices (information and compliance with company security policy, management of authentication procedures, reliability of passwords, online session management, phishing risks, etc...) and be duly trained.
- Network security: The architecture of the computer system must make it possible to preserve resources, by segmenting the network according to the degree of sensitivity and by using different protection devices (firewall, demilitarized zone, VLAN, network antivirus, etc...).

	Contribution of SUNSYS HES L Marine to cybersecurity: Interfaces must be accessed using secure versions of standard communication protocols: - FTPS: secure data export - HTTPS: secure browsing on the web server
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- Device security: Security depends on the network environment, but also on user behavior. In terms of environment, it is strongly recommended to apply basic protection measures (filtering of authorized stations by MAC address, opening of service ports, choice of authorized applications, etc...). Greater caution should be exercised when handling mobile media (external hard drive, USB key, wireless communication equipment, etc...). Finally, the energy storage system must be protected by controlling and limiting physical access to cabinets that house electronic equipment.

- Data security: Data security covers several aspects, in particular the confidentiality, integrity, authenticity and availability of data. Particular care should be taken with regard to data security and archiving procedures on backup devices, both internal and external to the company.

	Contribution of SUNSYS HES L Marine energy storage system to cybersecurity: It is possible to export data, such as energy indexes, load curves and historical measurements, manually or automatically, for backup purposes. Confidentiality is guaranteed by AES 256-bit encryption (AES 256) for personal data. This means that it would take 2^{256} combinations to decipher the encryption key.
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- Access and authentication management: Managing access to resources and data is an essential aspect of the IT systems security policy. Each user must have an account and access rights corresponding to their profile.

	SUNSYS HES L Marine access: From the web interface, the user has the possibility to reset the alarms and to change the configuration of the local EMS. SUNSYS HES L Marine control is carried out in Modbus TCP. Therefore it is highly recommended to limit the hosts allowed to access the system. These access restrictions can be implemented by: - The implementation of firewall rules at the level of the client Ethernet network by limiting the IP addresses or MAC addresses to access the Web interface of the storage system. - When commissioning the energy storage system, Socomec technicians configure it to limit access in accordance with the information provided by the customer.
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	Installation recommendation: For stability and performance reasons, the connection between the PMS and the PMS extension must not be connected to other networks. In the same way, the connection between the storage system and the CRE card must not be connected to other networks.
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3. OVERVIEW

The information in this manual is provided to aid in the installation, operation, and maintenance of the SUNSYS HES L Marine energy storage system. Please read, understand and follow the procedures given to ensure trouble-free installation and operation.

3.1. General description

The SUNSYS HES L Marine is a fully integrated AC connected energy storage system that supports a host of applications such as firming renewable production, stabilizing the electrical grid, controlling energy flow, optimizing asset operation and creating new revenue which provides greater control, efficiency and reliability across the electric grid. Another important function of the system is to provide backup power in the event of a grid failure or during power quality anomalies, therefore we are supplying the Island Mode version of the system.

The SUNSYS HES L Marine system comprises two major cabinets namely, a converter for DC to AC conversion (referred to as C-Cab) and the Battery cabinets (B-Cabs). The unit has been designed to operate natively outdoors, potentially making installation simpler and not burdening the facility cooling and ventilation systems. This unique capability is facilitated by utilizing liquid cooling loops for the batteries which minimizes the cabinet flow through air volume, facilitating internal environmental control using filtered normal environmental air. The battery requires tighter temperature control for life and performance, consequently the battery cabinets utilize an active chiller to control the temperature within closely controlled limits to maximize battery life and performance. For the C-Cab an HVAC is used to avoid any ingress of salted air and in order to keep internal ambient under controlled conditions. Active cabinet heating is also employed for low temperatures and humidity condensation control.

The internal power flow between the modules of the system is controlled by a Power Management System (PMS), which is integrated inside the C-Cab.

The SUNSYS C-Cab L Marine, shown in Figure 1, comprises the conversion modules of 50kVA each with their control, an automation box that can contain the PMS and IoT devices, a DC part with protection and connection and an AC part with protection and connection.

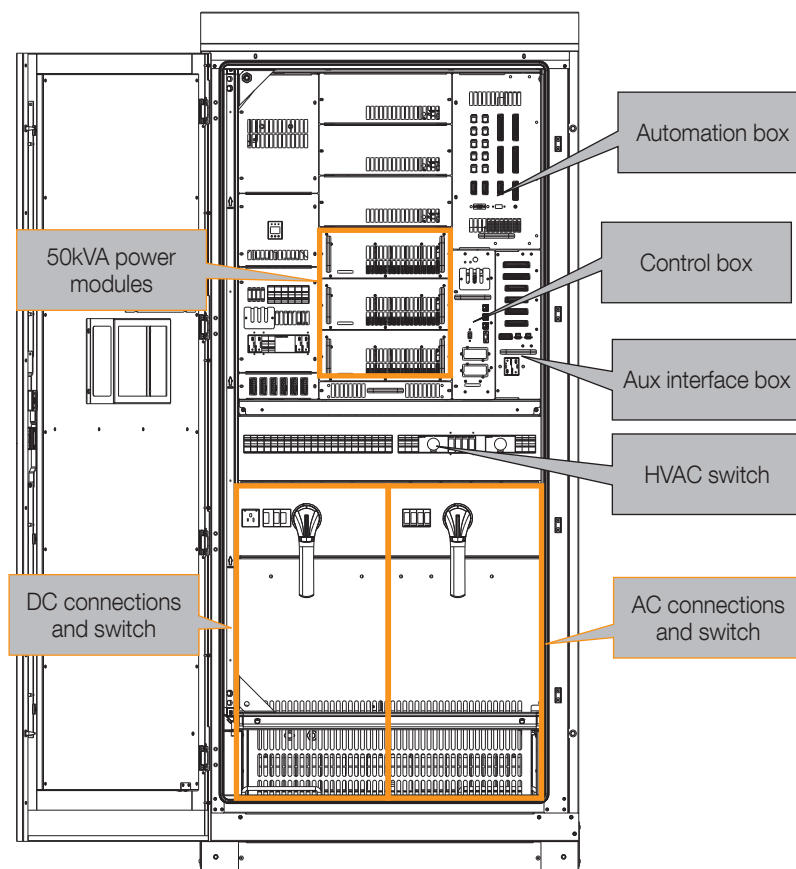


Figure 01. SUNSYS C-Cab L Marine composition

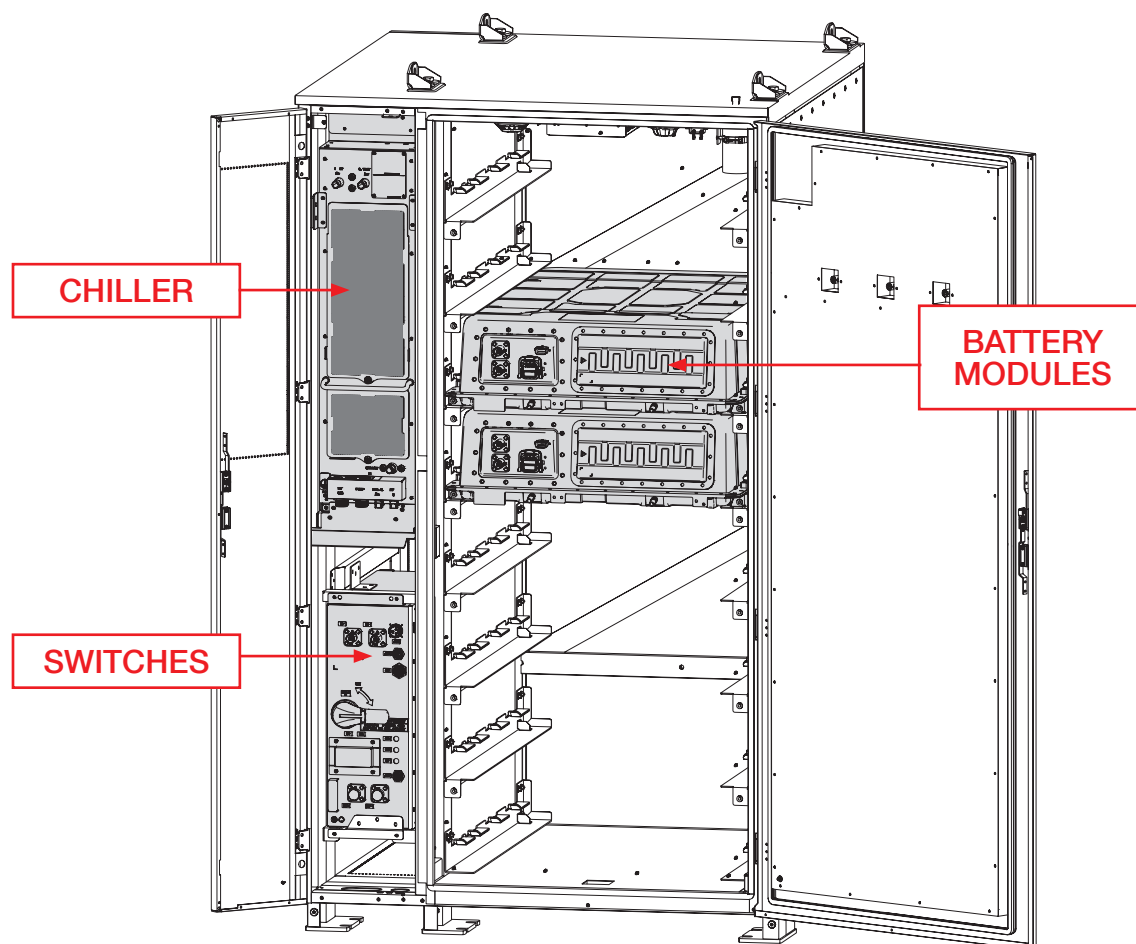


Figure 02. SUNSYS B-Cab L composition

3.2. Model

The C-Cab is composed of the 400Vac cabinet (SUN-HESL-M-400) integrating an auto-transformer, operational at 50Hz, with up to 4 modules of 50kVA each (SUN-HES-MOD50) installed.

C-Cab Available power sizes:

Frame 1: one SUNSYS C-Cab L Marine Master from 100kVA to 200kVA, modulo 50kVA

Frame 2: one SUNSYS C-Cab L Marine Master + one SUNSYS C-Cab L Marine extension, from 250kVA to 400kVA, modulo 50kVA.



Figure 03. View of Frame 1



Figure 04. View of Frame 2

For the specific as shipped unit configuration please refer to the nameplate included with each unit or contact Socomec for support with reference to the nameplate serial number. Units may be additionally supplied with configurations and options as defined by the customer at time of order.



The cabinets can be padlocked using a <10mm diameter padlock - not provided by Socomec.

B-Cab Frame: 186kWh 4 modules



Figure 05. View of the B-Cab



The batteries can not be padlocked, they are locked by the use of a key.

3.3. List of dedicated components

Each C-Cab can have different options installed, allowing a very high flexibility of setup to satisfy the user's requirements.

In the table below are listed all the optional components that can be installed inside the unit.

The items having spare parts available can also be installed outside of the factory, while the other items can only be installed in the factory.

Only options provided by Socomec can be installed inside the unit.

ID	Item		C-Cab Master	C-Cab Extension	Description
1	PC tablet		Yes	No	Support plate for a computer
2	Parallel board		Yes	Yes	"Parallel board" to parallelize Master and Extension C-Cabs
3	Auxiliary supply SPD		Yes	Yes	SPD for auxiliary power supply Required if the Overvoltage Category of the supply line is OCV>II
4	SPD DC		Yes	Yes	SPD for additional protection of the DC input line.
5	UPS		Yes	Yes	UPS for auxiliary line For protection of the auxiliary supply line during service interruptions
6	Insulation monitor	RCD	Yes	Yes	Residual Current Detector
7	Neutral contactor		Yes	Yes	Contactor to manage the Neutral wire connection/disconnection
8	ETH switch		Yes	No	Ethernet switch
9	Router		Yes	No	CheckPoint 1570R Ethernet router
10	Wireless 4G modem		Yes	No	Wireless 4G-modem + spare Antenna (Sierra Wireless) The antenna is delivered as spare-part w/ the C-Cab, i.e., not mounted on the roof top in the factory
11	PMS (Power management System)		Yes	No	PMS package (PLC, I/O, relays, commons)
12	Digiware package for PMS		Yes	Yes	Digiware meters for the PMS (M70, U-30, I-35 + probes) to be installed in the C-Cab Master and Digiware meters for the PMS (I-35 + probes) to be installed in the C-Cab Extension
13	Diris AUX power supply measurement		Yes	Yes	Diris B-30 device for AUX power supply measurement
14	Internal HMI for Automation		Option	No	Schneider 10" display for the Automation package
15	Data logger		Yes	No	Socomec H-80 Industrial PC
16	Battery control package		Yes	No	CATL battery control devices (MBMU + ETH box)

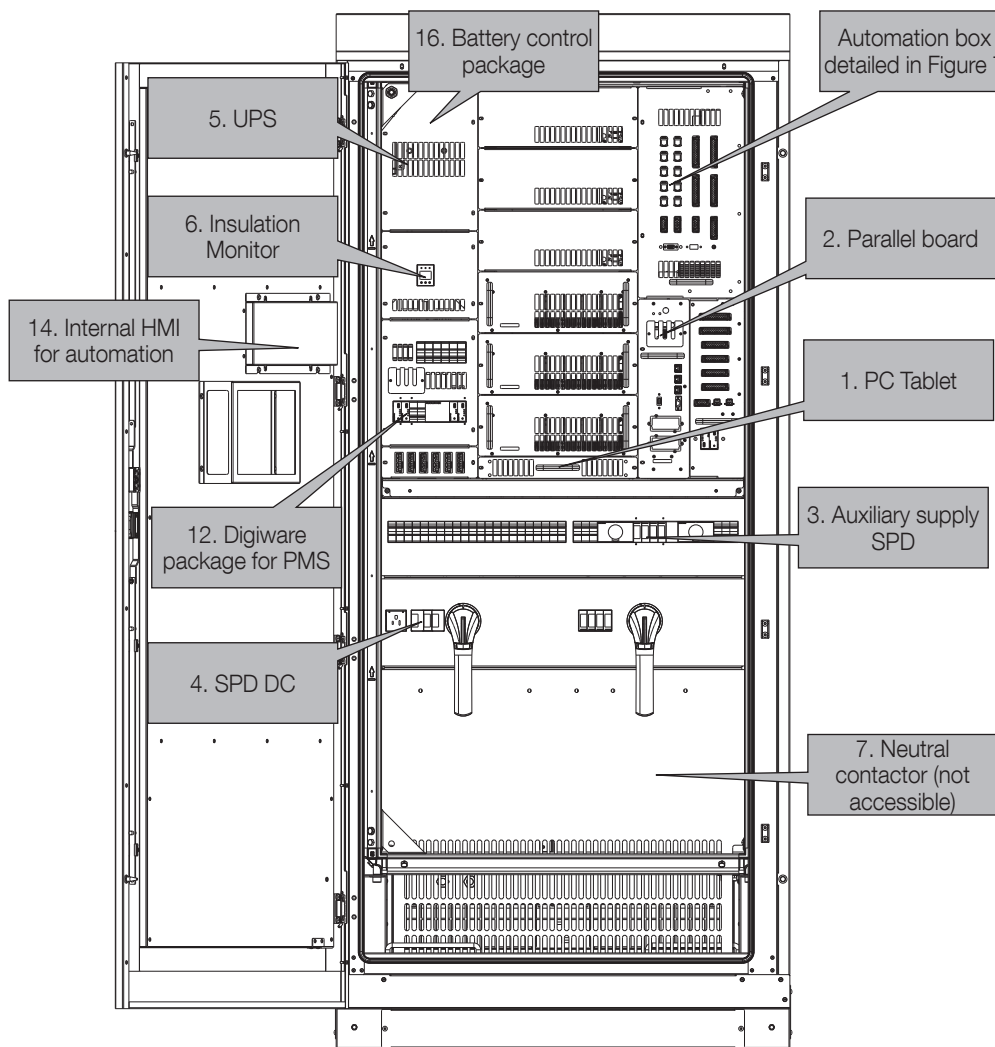


Figure 06. View of the dedicated components inside the C-Cab

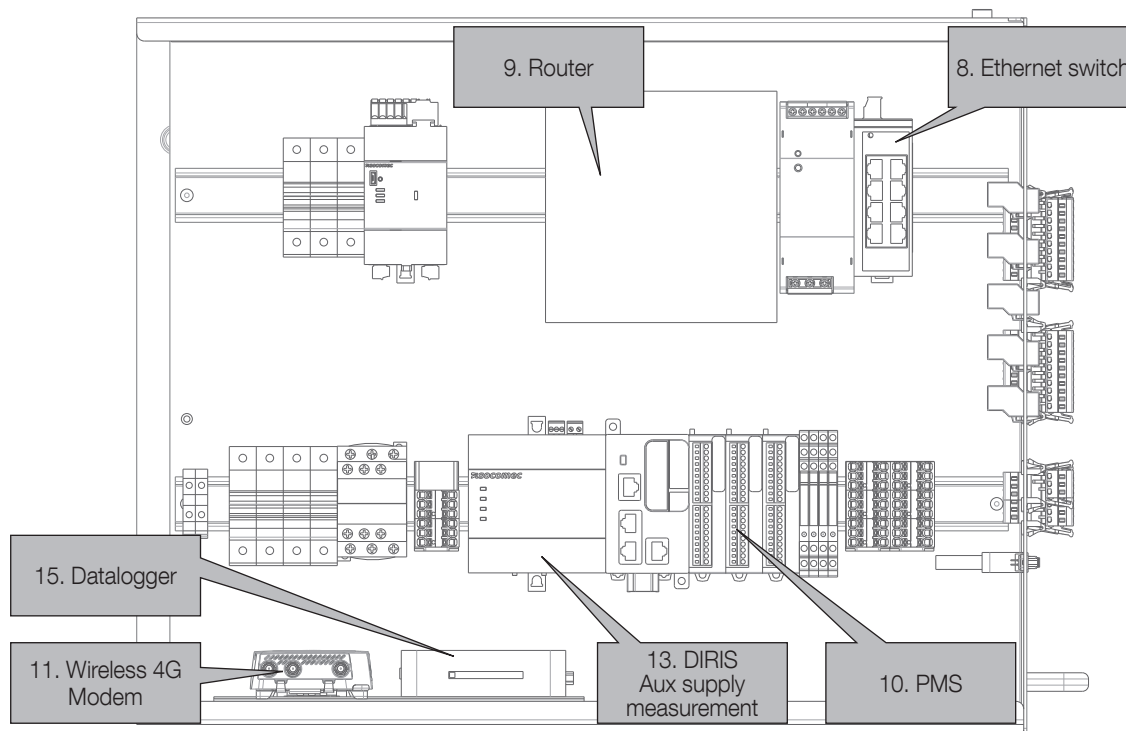


Figure 07. Detailed view of the Automation box

3.4. Devices with frontal access

When the C-Cab's door is open, it is possible to access to all the devices and ports available on the front of the machine. These devices are described in the figures below.

Some of them are optional and may not be present, as explained in the “List of dedicated components section.

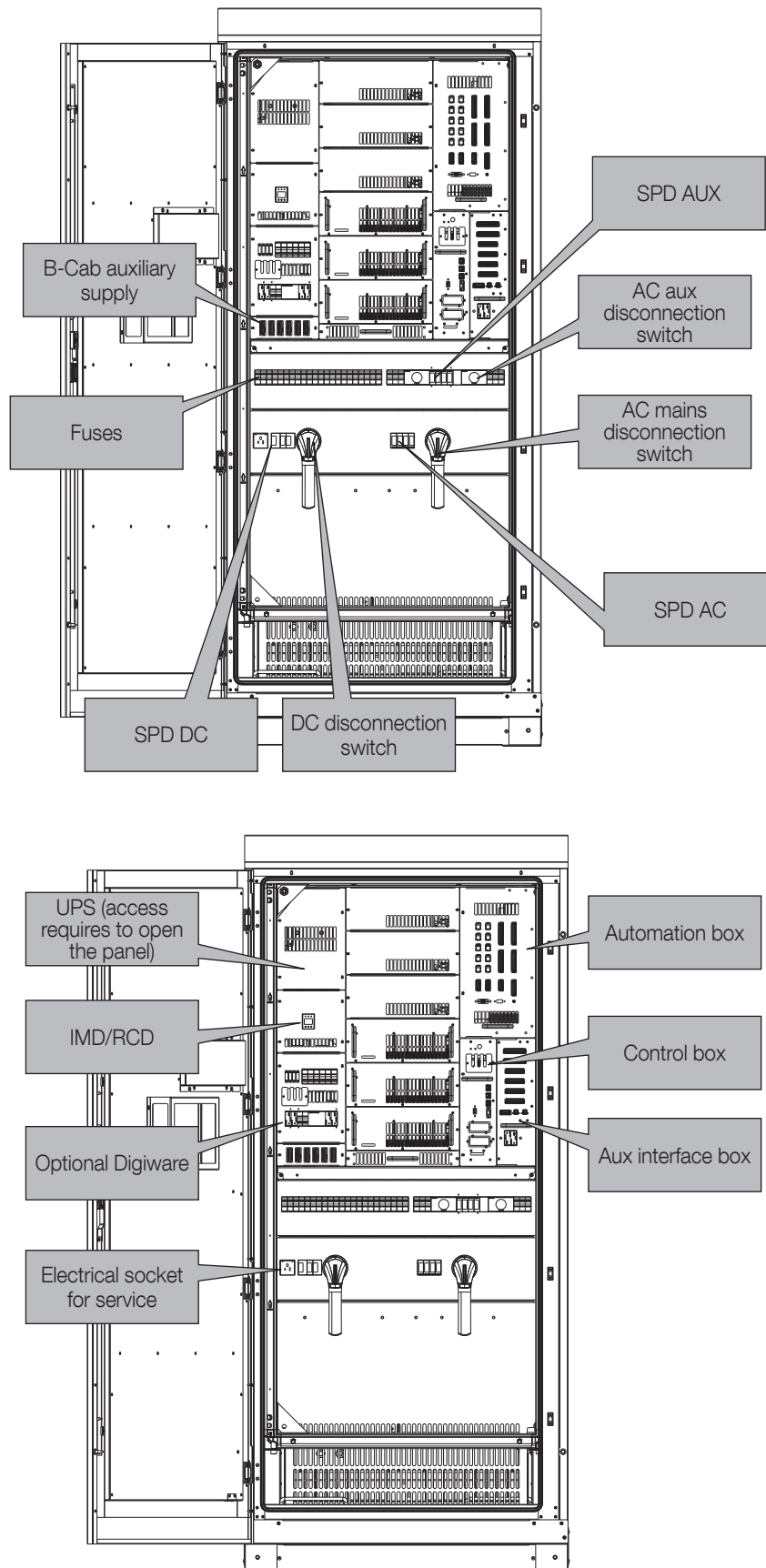


Figure 08. View of the devices accessible from the front of the C-Cab

3.5. Topology

The SUNSYS C-Cab L Marine has been designed to operate autonomously thanks to the PMS (with compatible batteries) or from the external commands of a device called Energy Management System (EMS) which is not a part of this manual. The EMS is provided by a third party and has full control over the Energy Storage System (ESS).

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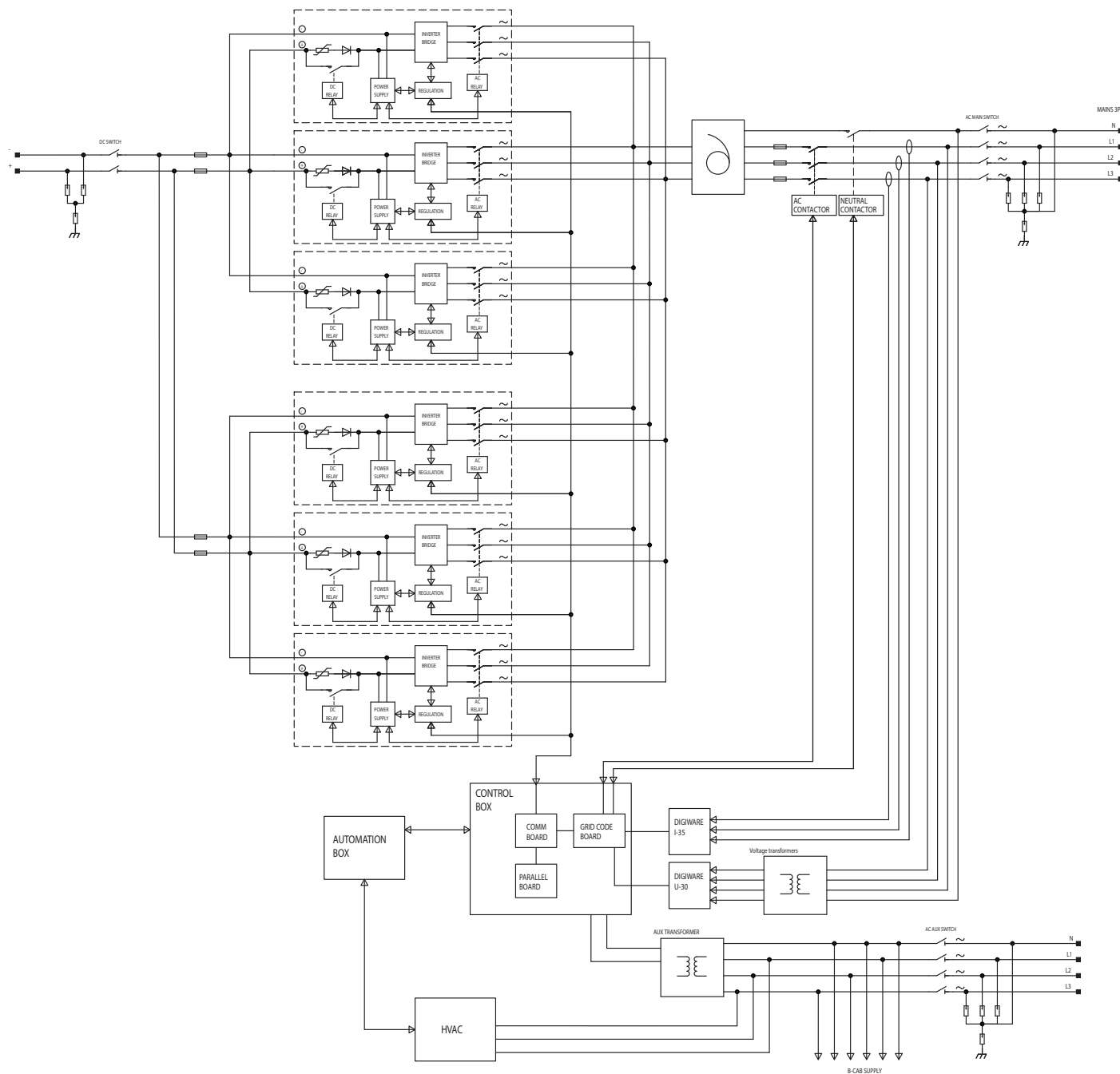


Figure 09. Example of C-Cab layout with autotransformer and options installed

3.6. Modes of operation

The system is designed to operate in the following modes of operation:

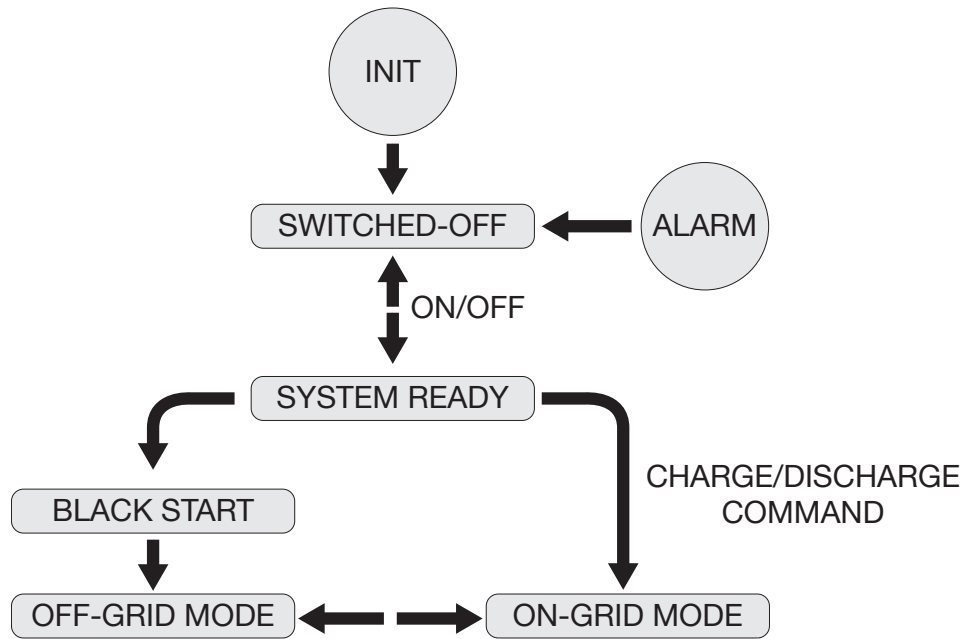


Figure 10. Modes of operation of SUNSYS HES L Marine

3.6.1. On Grid Mode

SUNSYS HES L Marine is a Grid Follower, meaning output voltage and frequency are imposed by the mains. The C-Cab operates according to active and reactive power set-points, provided by PMS/EMS, to exchange active and reactive power with the mains, both in injection and absorption.

When operating in On-Grid, the C-Cab is a grid-tied AC current generator controlled as a Current Source Inverter. AC current exchanged with the mains is controlled by an inner current control loop, driven by P and Q set-points.

During this Operation Mode all the criteria defined in the Grid Codes are met, from the point of view of both Interface Protection Requirements and Grid Support Functionalities.

3.6.2. Off-Grid Mode

SUNSYS HES L Marine is a Grid Former, meaning output voltage and frequency are imposed by C-Cab itself.

In this operating mode the C-Cab is controlled as a Voltage Source Inverter. Active power and reactive power exchanged with the bus depend on loads and generators connected to AC bus (Microgrid).

The C-Cab is disconnected from the grid and it autonomously manages the microgrid parameters such as voltage, frequency and phase accurately. The Off-Grid Mode is also called grid-forming mode.

3.7. Environmental controls

The system is designed for the IP55 & NEMA 3R enclosure requirements for the operation in an outdoor environment at the specified temperature ranges and up to 100% humidity non-condensing.

However, the converter and batteries have different environmental control strategies described as follows:

The C-Cab environmental control is maintained by a HVAC. Additionally, the cabinet has double skin which prevents entry of water, maintaining IP degree.

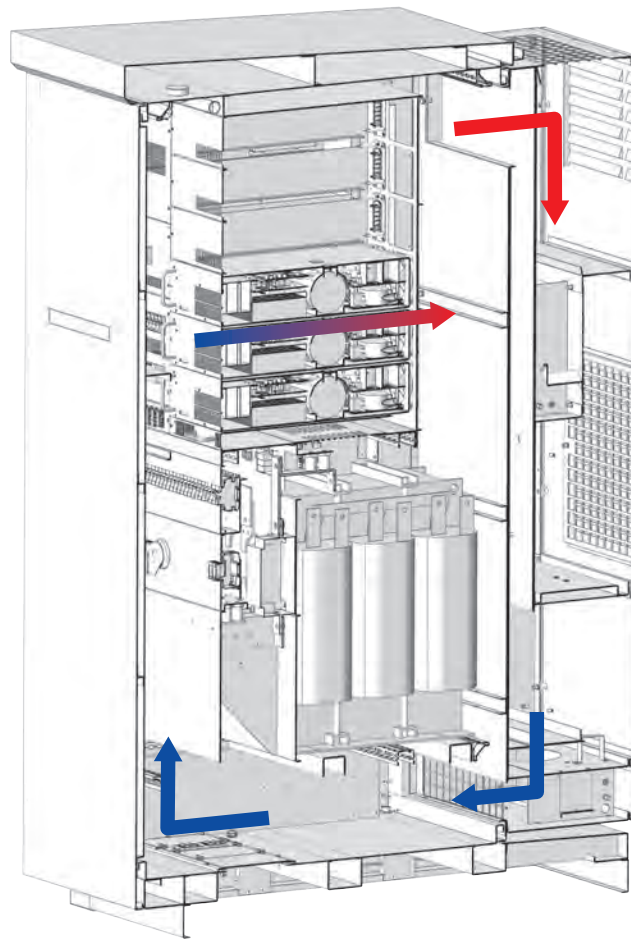


Figure 11. Air flows inside the SUNSYS C-Cab L Marine

The environment control is divided in different sub logic that acts at different level and that can be either controlled by software logic or electro-mechanical actuators.

The deepest level of logic is the one managed directly by module. Each converter has its own fan and set the rotation speed according to the level of load and certain components temperature.

On top of that there is a logic controlling the temperature and the humidity inside the cabinet, in order to avoid damages to its electronic components.

This logic is called the environmental logic. According to the cabinet temperature, the ambient temperature and the humidity measures, this logics will apply the minimum level of heating, cooling and ventilation to protect the machine from any potential damage due to environmental conditions.

3.8. System communication

3.8.1. Communication with external EMS

The energy exchange (charge/ discharge) of the system can be managed by an Energy Management System (EMS) that performs remote operations.

This EMS will pilot the PMS using the Modbus TCP / SunSpec protocol.

The connection is realized with an Ethernet RJ45 cable. The C-Cab IP address will be defined during commissioning.

Socomec is member of the SunSpec organization.

The SunSpec specifications are available on the SunSpec site <https://sunspec.org/>.

Supported models

Model	Label	Description
1	Common	All SunSpec compliant devices must include this as the first model
701	DER AC Measurement	DER AC measurement model.
702	DER Capacity	DER capacity model.
703	Enter Service	Enter service model.
704	DER AC Controls	DER AC controls model.
705	DER Volt-Var	DER Volt-Var model.
706	DER Volt-Watt	DER Volt-Watt model.
713	DER Storage Capacity	DER storage capacity.
715	DER Ctl	DER Control
802	Battery Base Model	Battery Base Model
803	Li-ion Battery Bank Model	Lithium Ion Battery Model

The communication is checked by writing a heartbeat value in the 715 model, it must change every second.

To control the DER, we use the models 715 for ON/OFF controls.

The DER set points are defined by the model 704. To control the battery, we use the model 802.

Reading the model 701 it will give you access to the states, alarms and measurements.

Start sequence

Model	Offset	Name	Value	Action	Description
715	7	AlarmReset	1		Reset the alarm
715	7	AlarmReset	0		After a delay of 1 second
802	50	SetOp	1	CONNECT	Connect the battery, you have to wait the precharge before starting the PCS
715	8	OpCtl	1	START	Start the PCS
704	22	WSetEna	1	ENABLED	Enable the active power control
704	23	WSetMod	1	WATTS	Not a percentage but a value (can be another value)
704	24	WSet	active power value		Active power set point
704	35	VarSetEna	1	ENABLED	Enable the reactive power control
704	36	VarSetMod	3	VARs	Not a percentage but a value (this setting can have another value)
704	37	VarSetPri	0	ACTIVE	This setting can have another value
704	38	VarSet	reactive power value		Reactive power set point

Stop sequence

715	8	OpCtl	0	STOP	Stop the PCS
802	50	SetOp	2	DISCONNECT	Disconnect the battery, you have to wait 5 minutes before switching it on again

3.8.2. The PMS

The PMS acts as the controller for the converter and the batteries. The PMS derives its operational intelligence to operate the system based on the following:

- Modbus TCP / SunSpec communication to the converter for control & operational data, connection through Eth10.
- Modbus TCP communication to external power meter tfor voltage, current and power measurement - internal connection.
- Modbus TCP / SunSpec communication with the EMS for remote control, connection through Eth1.
- Modbus TCP communication to batteries for control & operational data, internal connection.

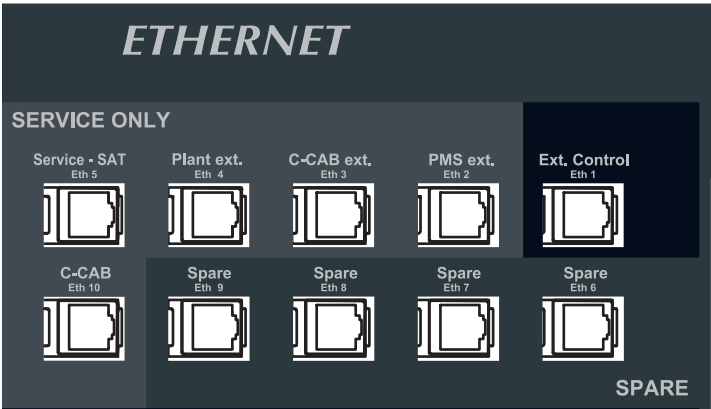


Figure 12. Ethernet connection ports

4. TRANSPORT, STORAGE & HANDLING

The instructions provided here are intended as a guide to the transportation, storage and handling of the unit. For full dimensional and connection details, please refer to the outline drawings and electrical schematics provided with the unit. For further support, please contact Socomec.

4.1. Transport



Customers have the responsibility of the transportation of **all the parts** from our sites to the final installation site. SOCOMEC declines all responsibility on any damage caused during the transport.

The choice of the type of transport is the responsibility of the customer, but needs to follow our requirements below and shall be decided in accordance with transport laws of the country crossed during the travel.

To ensure optimal conditions during the transport, you must transport the system in a High Cube container: equipment rigging, packing, etc.

Note that for transport, the batteries have to travel in a separated container, for security reasons. This container has to respect the following requirement: Transport for hazardous material.

The transport and storage temperature must be between -30°C and $+60^{\circ}\text{C}$.

A forklift shall do the unloading of the container.

4.2. Inspection

The unit is shipped on a wooden pallet. Power modules are shipped separately.

Upon receipt of the equipment, immediately inspect for damage that may have occurred during transit. Any damage claims are to be filed with the carrier and reported to Socomec expeditiously with serial number information and carrier details.

Check also that the content is complete.

The following items are shipped with the C-Cab:

1. Removable connectors mounted on each available port; there are 2 types of connectors.



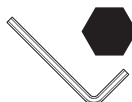
Figure 13. B-Cab aux supply connectors



Figure 14. Other plug-in connectors

The number may vary according to the options installed; verify that all the connectors on the front panels are covered with their removable counterparts.

2. Tamper proof allen key for rear panel opening, provided in a dedicated bag.



The following items are shipped with the installation kits:

1. MSD

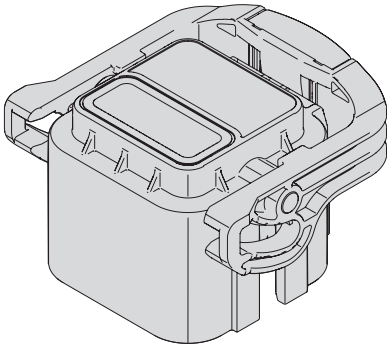


Figure 15. MSD

4 pieces per B-Cab of MSD are delivered and their installation must be conducted by Socomec team after the fixation of the cables and not before commissioning.

4.3. Storage

Store the cabinets in a dry and clean location protected from the elements and ensure that the ventilation openings remain covered to prevent the entry of moisture or dust. No harmful gases, flammable or explosive products and corrosive chemicals are allowed in the battery warehouse. The recommended storage temperature is about 20°C +/- 3°C with a daily average storage temperature $\leq 25^{\circ}\text{C}$ to preserve the life of the battery and limit its self-discharge, though the allowed range of temperature is -20°C to +60°C.

For storage duration exceeding 1 month, please contact Socomec.

4.4. Handling and Moving



WARNING!

The packaging guarantees the stability of the unit during shipping and physical transfer. The unit must remain in a vertical position during all shipping and handling operations. Ensure that the floor is strong enough to support the weight of the unit. Carry the packaged unit as close as possible to the installation site.



WARNING!

Move the unit using a fork lift truck taking the utmost caution at all times. At least two people must handle the unit. The people **MUST** take position at the sides of the cabinet with respect to the direction of movement. Do not move the unit by putting pressure on the front door nor back plate. When moving the unit on even slightly sloping surfaces, use the locking equipment and braking devices to ensure that the unit does not fall over.



WARNING!

Provide vertical support while moving the unit due to its height and relatively high centre of gravity; move slowly with care to avoid tipping.

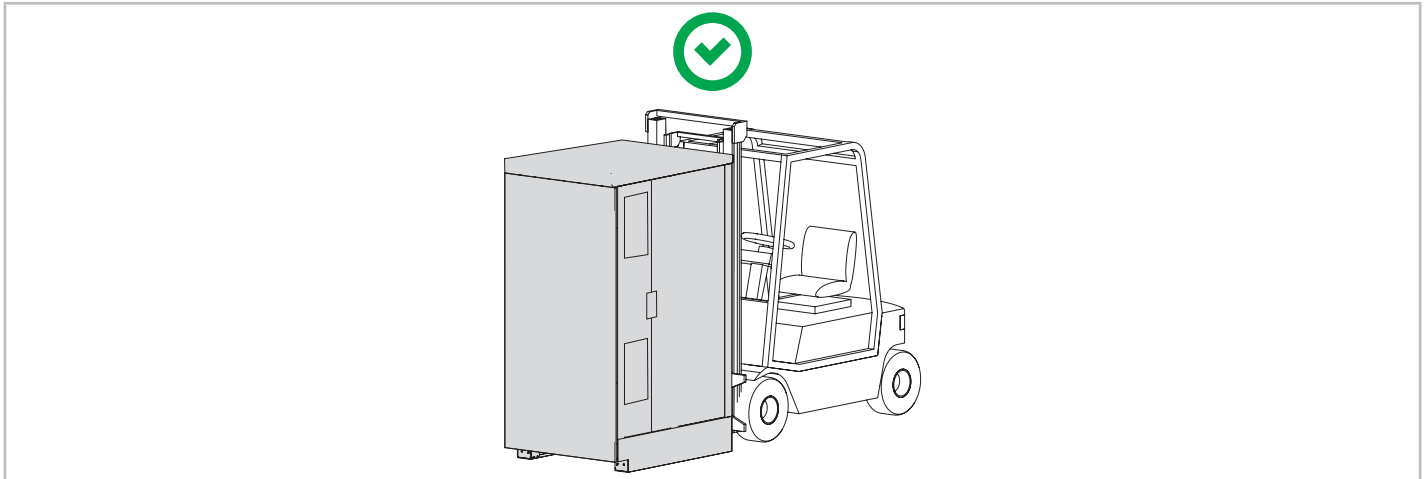
C-Cab and B-Cab are shipped individually mounted on individual pallets.

If you need to transport through a building the minimum opening, with the roof installed, must be 1050mm x 2330mm for the C-Cab, DC-Cab and AC-Cab and 1350mm x 2330mm for the B-Cab.

4.5. Forklift or Pallet truck handling

• B-Cab

Handling of the B-Cab needs to be done from the rear side of the cabinet, as shown on the figure below.



1. The forklift arm needs to be protected to avoid dirt pollution on the fork arm, or the forklift scrapes the bottom of the cabinet.
2. Before the forklift fork arm reaches into the bottom of the cabinet, make sure the height of the fork arm is lower than the bottom of the cabinet to avoid collision with the cabinet.
3. After the forklift fork arm reaches into the bottom of the cabinet, make sure that the fork arm are visible on the other side of the cabinet.
4. Forklift transport process should be maintained at a uniform speed.
5. Pay attention to the electric cabinet when transferring forklift truck.
6. Forklift model selection should consider the total weight of rack.

• C-Cab

Prior to use the Gradall forklift with the C-Cab remove the front and rear panels (as shown below).

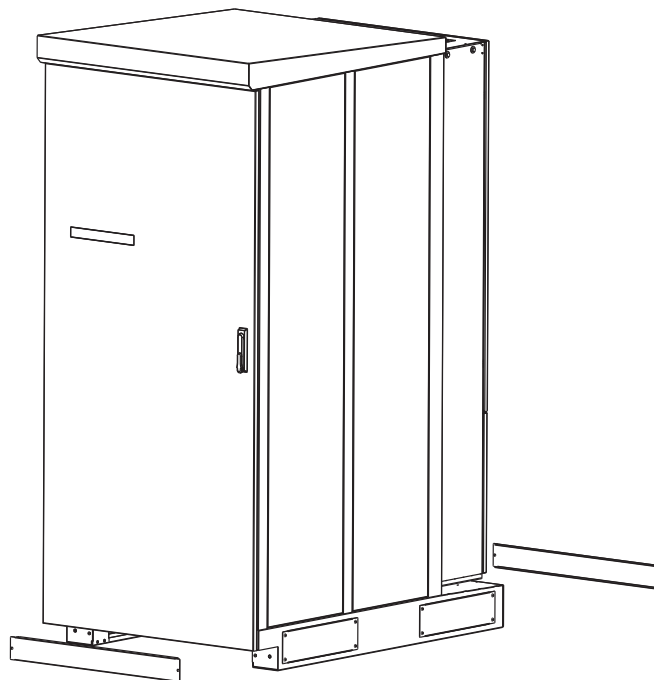


Figure 16. Panels to remove from the C-Cab

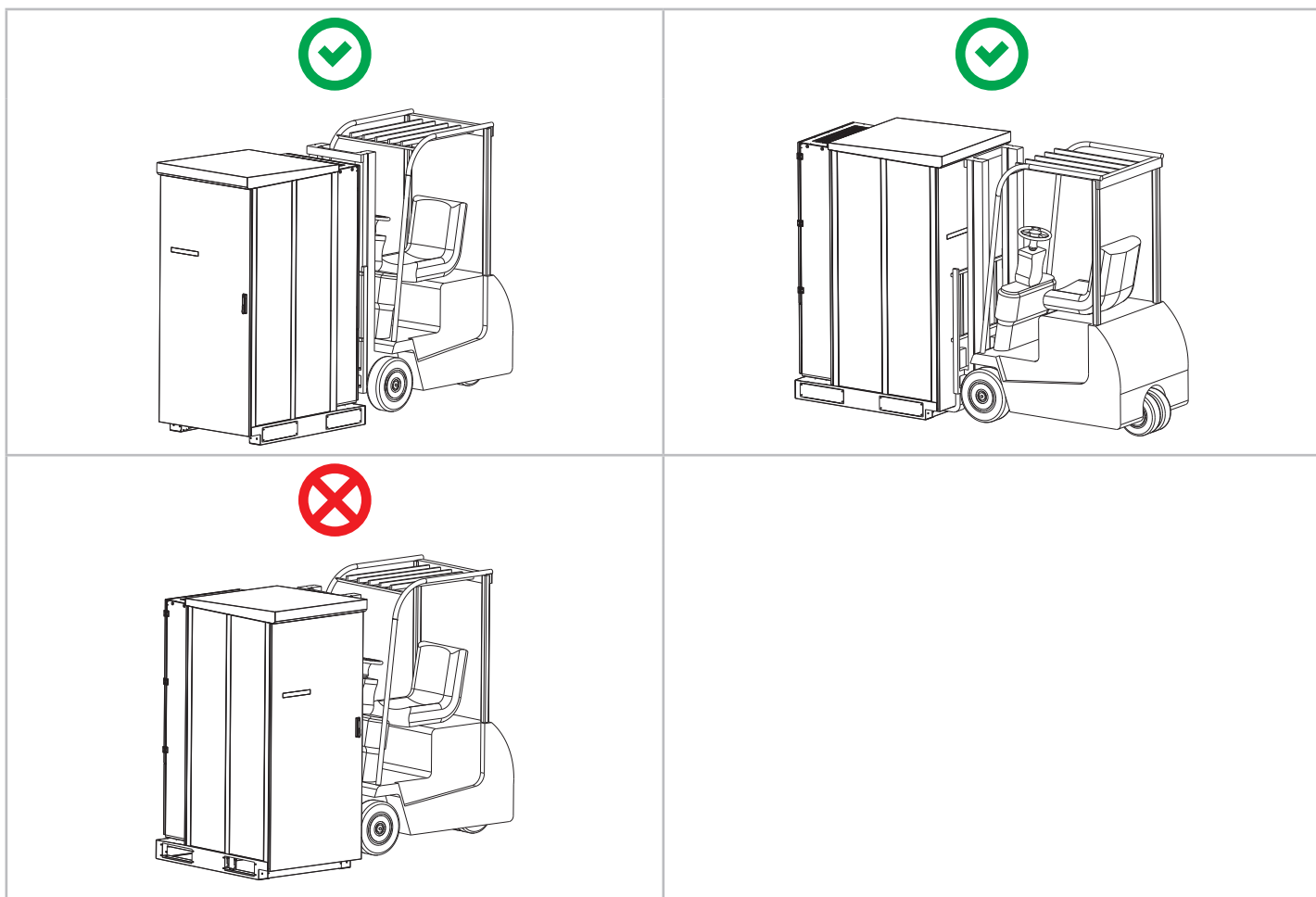


Figure 17. Handling of the unit using pallet truck with 1.30m long forks

(screen shall be at the back, if not possible it can be at the front, but then take care of the screen)

4.6. Overhead lifting

If a crane is available on site, it is possible to handle the unit from above.

• B-Cab

4 lifting lugs are on the top of the unit.

The radius of the hole on the lifting lug is 11mm / 0.43in.

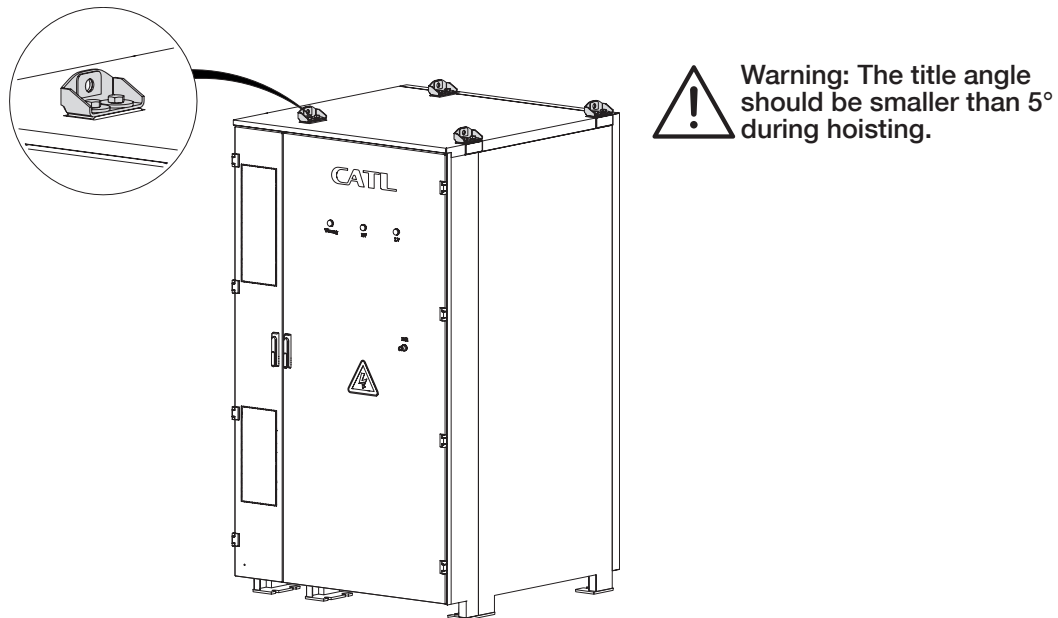


Figure 18. Lifting lug on the top of the rack

• C-Cab

- Open the door and remove the front screws:

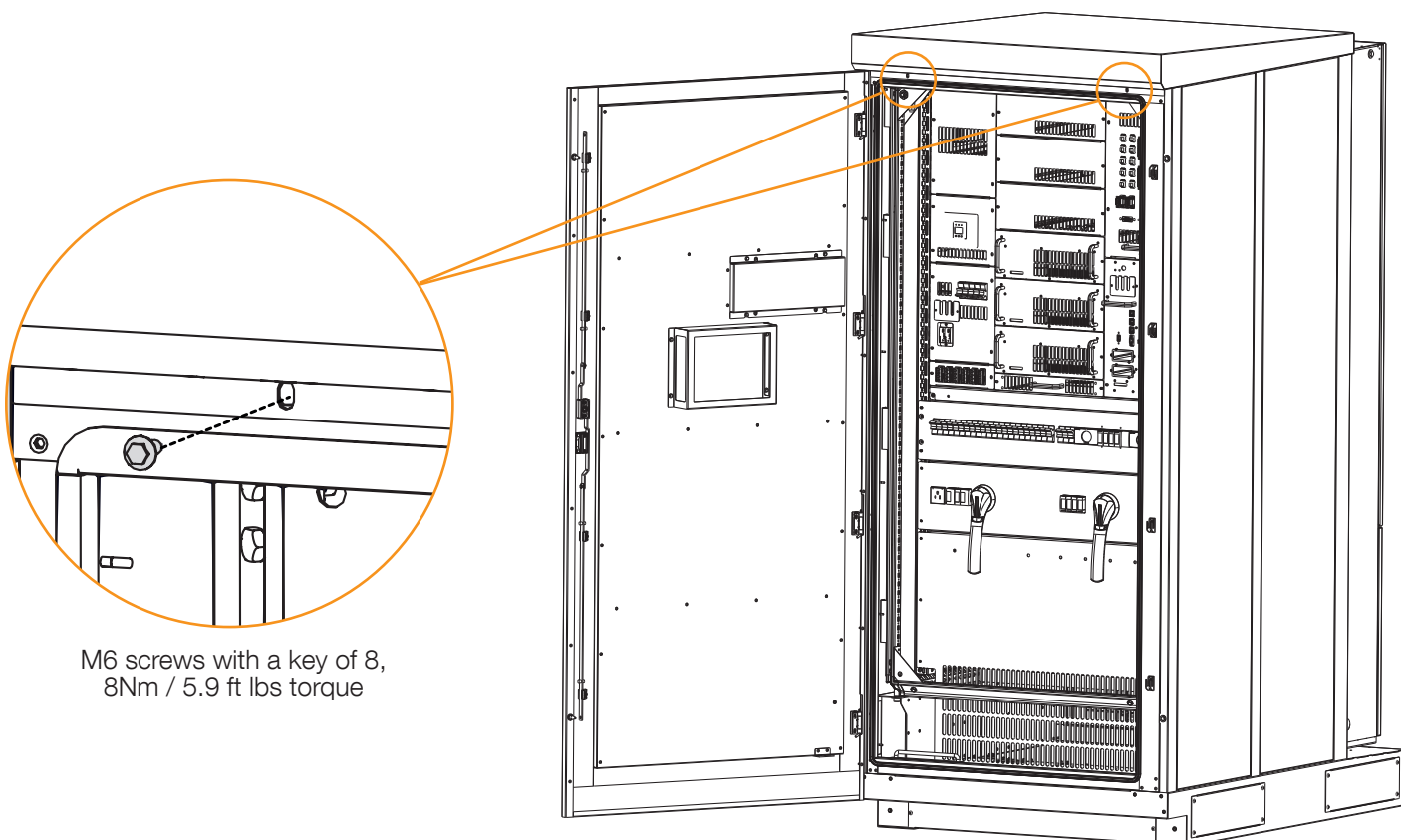


Figure 19. C-Cabs front top screws

- Remove the roof and replace the 4 screws by M12 lifting rings, we recommend you to use double swivel rings (not supplied):

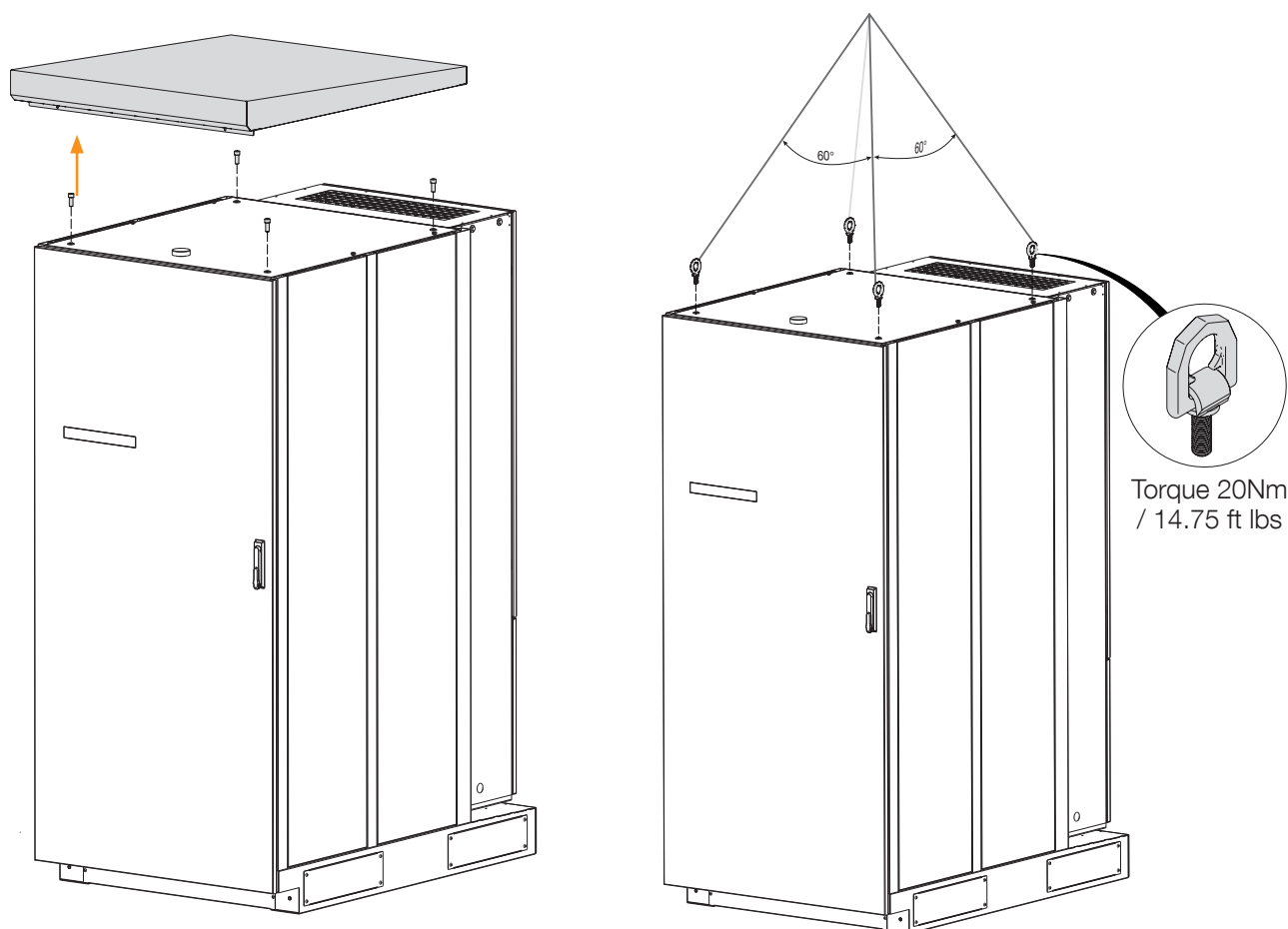


Figure 20. Lifting lugs on top of the C-Cab

- Should you not use double swivel rings but basic ones; you will need to use a vertical load spreader, not supplied (as illustrated below) for handling.

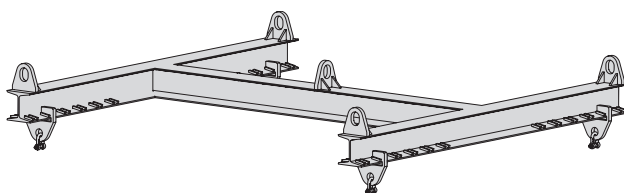


Figure 21. Vertical load spreader



CAUTION!

While lifting it is important to ensure even vertical load, distribution on all the lifting eyes and slowly lift and move into a prepared location while observing standard safety protocols. Do not use slings or straps without spreaders to lift the units from above.

No tilting is permitted. The unit cannot be laid.

5. PREPARATION

5.1. Civil and foundation requirements

SUNSYS HES L Marine must be installed on a concrete pad that must:

- be of a suitable size, minimum:
 - 150mm deep – for SDS* (Numeric seismic design value 0.2s) 1.5g;
 - 203mm deep – for SDS* 2.5g;
 - 508mm around the equipment.
- be free from conductive, inflammable and corrosive items;
- support the weight of the units and guarantee their stability, it shall be of a minimum capacity of 3000psi or 20.68MPa,
- respect a solid and perfectly levelled ground, in order to ensure the correct drainage of the water and avoid its stagnation
- respect the flatness / unevenness values in respect to DIN 18202: table 3, line 4.

To carry out the foundation calculations, it is necessary to take into account the loads that influence the ambient conditions, as per the country regulations.

*0.4 SDS (FMEA) is equivalent to aN (PS92)

Dimensions in/mm

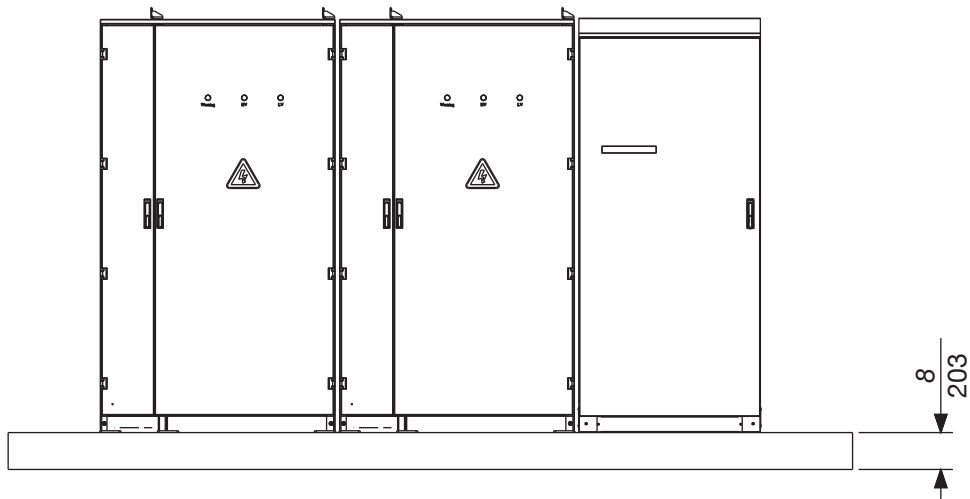


Figure 22. Concrete depth – SDS 2.5

The anchor road must be of the following embedment length:

- 76.2mm / 3.25in for both C-Cab and B-Cab for SDS 1.5g
- 76.2mm / 3.25in for the C-Cab and 152.4mm / 6.5in for the B-Cab for SDS 2.5g

And the bolts used must sustain the following characteristics:

SDS	Cabinet	Bolt diameter	Load	
			Tension	Shear
2.5g	B-Cab	M16 / 0.625inch	2954 lbs (13140 N)	2911 lbs (12494 N)
1.5g	B-Cab	M16 / 0.625inch	1525 lbs (6784 N)	1747 lbs (7771 N)

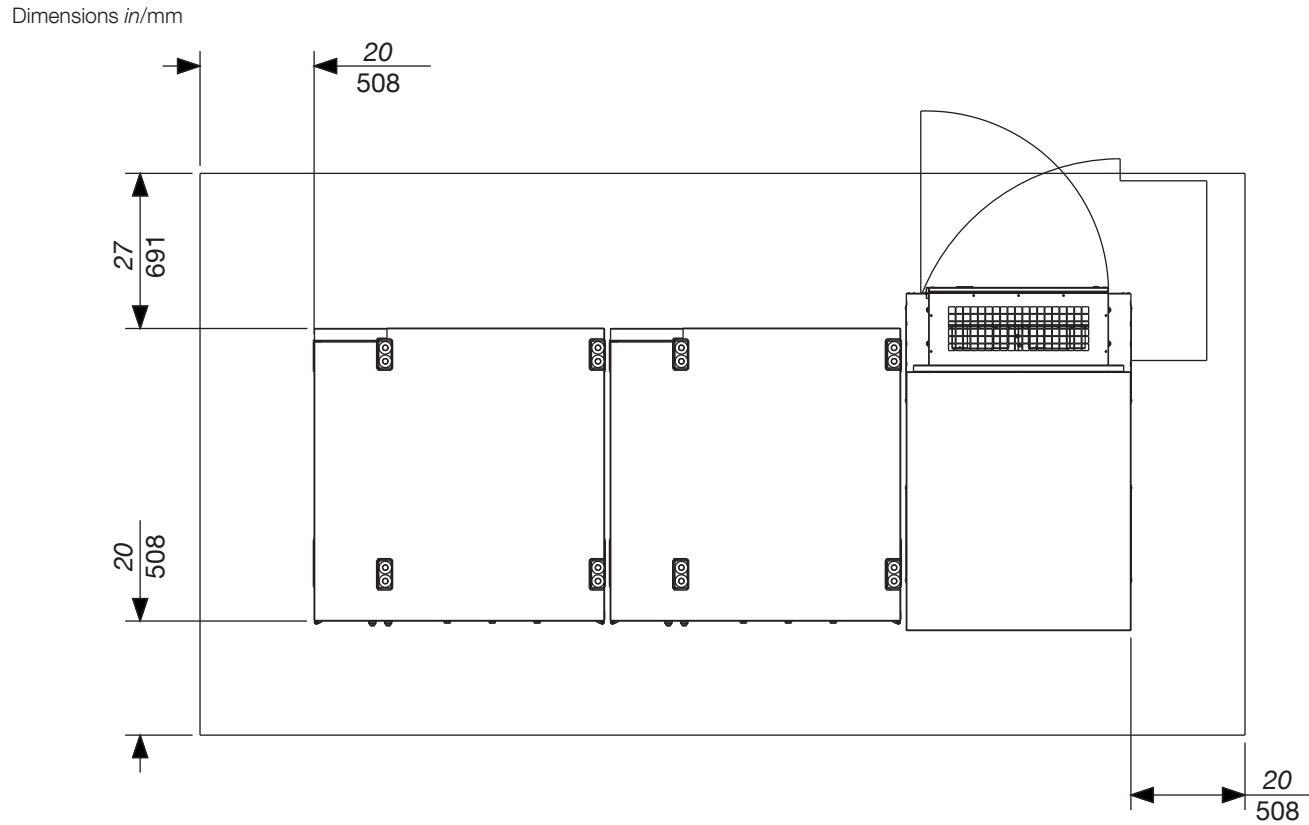


Figure 23. Concrete space around the equipment

5.2. Commissioning prerequisite

5.2.1. Integration prerequisite

General	
1.	Check the exact match of component product number and rating with your order.
2.	Battery energy storage system includes a user manual (system description, operating and safety instructions, maintenance requirements, safe battery handling requirements/recommendations).
Integration check	
1.	Battery and converter are installed in a perfectly levelled ground concrete floor. Please provide a photo of the concrete floor with a spirit level to validate that there is no inclination.
2.	The distance area around the system is at minimum as required by SOCOMEC (please find distance required at chapter "6.2. Clearance distances", page 37). When using the cable trays supplied by Socomec, please make sure to respect the specified distances, therefore use the drilling template delivered.
3.	Please provide a photo of the all installation (overview - front side).
4.	Please provide a photo of the all installation (overview - back side).
5.	"If Modem 4G option. Check the well mounting of the antenna of the Modem in the roof of the C-Cabinet or other localisation. Please provide a photo. If it's in another localisation, please provide a plan."
6.	Verify the attachment of all unit to the concrete floor.
7.	Verify the attachment of all cable gutters.
Sensors	
1.	Make sure the sensor is accessible to the service team.
Installation Environment inspection and setting check	
1.	The area around the system is accessible.
2.	The area is secured : no civil work, stable floor, ...

5.2.2. Connection prerequisite

Grounding	
1.	Any conductive battery racks, cases or trays must be connected to an equipment grounding conductor.
2.	Equipment grounding conductor is properly identified as either bare, green, or green with continuous yellow stripe(s)
4.	Check the ground interconnection of all the B-Cabinets.
5.	Check ground connection on the C-Cabinet.
Interconnection / Electrical cable visual inspection	
1.	For all the system verify the connection (power and communication) of each cable is in accordance with the cable book, the single line diagram and the installation manual provided by SOCOMEC.
2.	Check the Emergency Stop loop connection.
3.	Please provide a photo of the AC Cable connection of the C-Cabinet.
4.	Please provide a photo of the Auxiliaries Cable connection of the C-Cabinet.
5.	Please provide a photo of the DC and auxiliaries Cable connection of the B-Cabinet.
6.	For Islanding. Check all connection with devices required by SOCOMEC.
Internet Connection (if no Modem 4G option)	
1.	Check the ethernet connection wiring from your site to the C-Cabinet.

5.2.3. IoT prerequisite

IP addresses for communication	
1.	Please provide an IP address to communicate with the PMS (Power Management System).
2.	Please provide an IP address to communicate with the M70 (Measurement Central device).
3.	Please provide the IP address range where the ESS system should be accessible.
4.	Please, do not connect the ESS system in the IP range 192.168.20.0/24 or higher (ie 192.168.0.0/16).
5.	Please provide an IP address to communicate with the HMI.
6.	Please provide an IP address for the gateway with the ESS.
Network access (if no Modem 4G option)	
1.	Please provide the network IP address range where the ESS system will be connected.
2.	Please give the NTP server IP address (optional if the customer doesn't want to open a NTP access).
3.	Please provide an IP address for the gateway with the ESS or provide DHCP server. If a static IP address is used, please provide a subnet mask and a default gateway.
4.	Please provide access to http port 80 to URL: http://ctldl.windowsupdate.com/msdownload/update/v3/static/trustedr/en/authrootstl.cab
Different access	
1.	Please make sure to open the following accesses: TCP port 257 TCP port 18191 TCP port 18210 UDP port 4500 UDP port 500 ICMP (ping) DNS port 53 (TCP and UDP) MQTT port 8883 (TCP) SNTP UDP port 123 https port 443 IP public 194.169.203.20 IP public 194.169.203.21

6. SYSTEM INSTALLATION

The instructions provided here are intended as a guide to the installation of the unit. For further support, please contact Socomec.

	HAZARD OF ELECTRIC SHOCK OR ARC FLASH This equipment is to be installed and maintained only by qualified personnel. Before working on this equipment ensure that all power is off and locked out following safe lock-out procedures. Use appropriate personal protective equipment (PPE) and follow safe electrical work practices when working in close proximity to live electrical circuits. Ensure all covers and doors are in a closed condition prior to applying power.
	DANGER OF TIPPING IF NOT PROPERLY HANDLED Provide vertical support while moving the unit due to its height and relatively high center of gravity; move slowly with care to avoid tipping. Ensure that lifting devices evenly distribute the load over the base or lifting eyes if used. Before carrying out any operations, ensure the C-Cab is secured at the feet.

6.1. Installation guidelines and considerations

The unit is to be installed in accordance with the prevailing local and National Electric Codes which governs the requirements for electrical installation. These requirements may include, but is not limited to:

- Input upstream overcurrent protection will be required by code specified by the engineer of record for the site for the protection of the input power cabling even though the unit has integrated overcurrent protection.
- Minimum access front aisle clearance: (typically 48" or 122 cm, refer to codes)
- Appropriately rated feeder and load conductors
- Grounding: Chassis Safety Grounding of the enclosure is mandatory (Electric Code requirements); # 2/0 or 70mm² minimum recommended
- AC connections:
 - Cable entry: Bottom. Refer to outline drawing.
 - Method of routing: Conduit. There is limited space between the cable entry plate and the floor (174mm). You may have to come straight out the slab to wire the cabinet.
- Battery cabinet interconnections:
 - Cable entry: Bottom
 - Method of routing: Use provided cable gutter and cables
Note: the unit is not prepared to use conduit connections. If required, contact factory for support.
 - Refer to section "7. Positioning", page 39 for requirements and instructions for cable gutter installation.
- The recommended layout for battery cabinets is single row connections i.e., cabinets connected in line.
- Torque all connections.

The following additional point must be considered in choosing a location:

- Ventilation Clearance: Exhaust at the rear of the units. Refer to chapter "6.2. Clearance distances", page 37 for further details.
- Battery Clearance: Limitation to specific installations at the rear of the units. Refer to chapter "6.2. Clearance distances", page 37 for further details.

6.2. Clearance distances

To ensure enough space for ventilation and allow the access for any intervention, the following clearance distances shall be respected in addition to any other local laws.

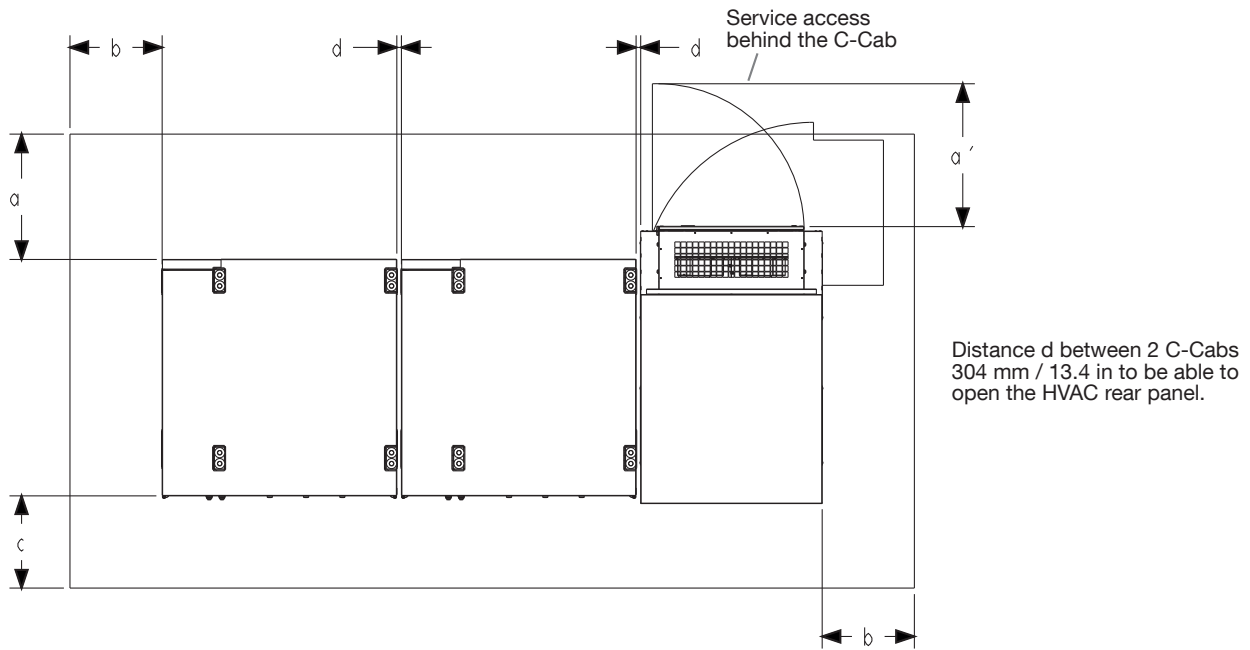


Figure 24. Clearance distances

	Distance a rear clearance	Distance a' rear clearance	Distance b side clearance	Distance c front access	Distance d between 2 units
Minimum clearance distance	Min. for the access 500 mm / 20 in* Min. for the airflow 100 mm / 4 in	800mm / 31.5 in**	500 mm / 20in	1500 mm / 59.1in	25,4 mm / 1in To enable the installation of the cable gutter please leave 25.4 +/-6mm / 1+/-0.04in.

*500mm / 20in is the minimum of space needed to operate. In case of removable back fence this fence can be installed at 100mm / 4in, enough for the ventilation, and once removed, we should have again the requested space to operate.

**700mm / 27.6in is the minimum of space needed to operate. In case of removable back fence this fence can be installed at 500mm / 20in, enough for the ventilation, and once removed, we should have again the requested space to operate.



WARNING!

System shall be separated by a minimum 3m/10ft from the following exposures:

- (1) Lot lines
- (2) Public ways
- (3) Buildings
- (4) Stored combustible materials
- (5) Hazardous materials
- (6) High-piled stock
- (7) Other exposure hazards not associated with electrical grid infrastructure.

Contact factory in case of specific need

6.3. Environmental conditions

SUNSYS HES L Marine has been designed to be installed in the following environmental conditions.

External Operating Condition		
Temperature range	-10°C / +40°C without derating +40°C / +45°C with derating	
Relative Humidity (non-condensing)	4-100 %	
Max. altitude above sea level	1000 m without derating	
Max. snow load	< 250 kg/m ²	
Solar Radiation *	< 1090 W/m ²	IEC 60721
Saline environment	Class C5	ISO 9223
Polluted environment (dust)	Pollution degree 3 4S13	IEC 60664-1 IEC 60721-3-4:2019

*According to the standard IEC 60721, SUNSYS HES L Marine is designed to solar radiation up to 1090W/m². Above this level, a protection cover shall be installed on the cabinet to reduce solar radiation exposition.

Please contact SOCOMEC to discuss a specific integration possibility for harsher environments.

7. POSITIONING

The required installation is in line (side-to-side). Back-to-back installation, for batteries, can be possible on specific request. See an example below:

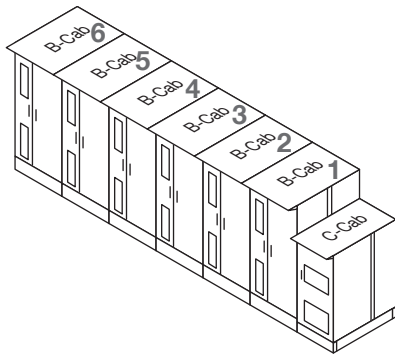


Figure 25. In line installation

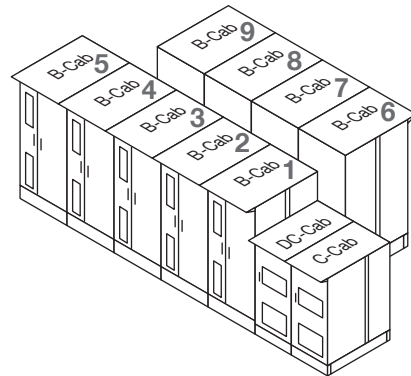


Figure 26. Back-to-back installation

The C-Cab and B-cab anchoring holes in the floor of the concrete base must be pre-drilled using the template provided and the mechanic anchoring installed before putting the cabinet in place.

Positioning of all cabinets is critical to ensure proper installation with the cable troughs from each battery cabinet.

Refer to the template provided to prepare the mounting location and install the cabinets into the designated place.

Drilling templates along with outline drawing dimensions will define the location of the cabinets. The drilling templates provided are an overlapping modular set, you will need to attach the 4 parts of the template together before starting.

Follow the procedure described below to prepare the mounting location as detailed in the template.

7.1. Cabinets order

From top view, the cabinets always have to be positioned as follows: the C-CAB on the right side and the B-CAB on the left side – from front face of the products. Installation must be started from the cabinet on the right (view below):

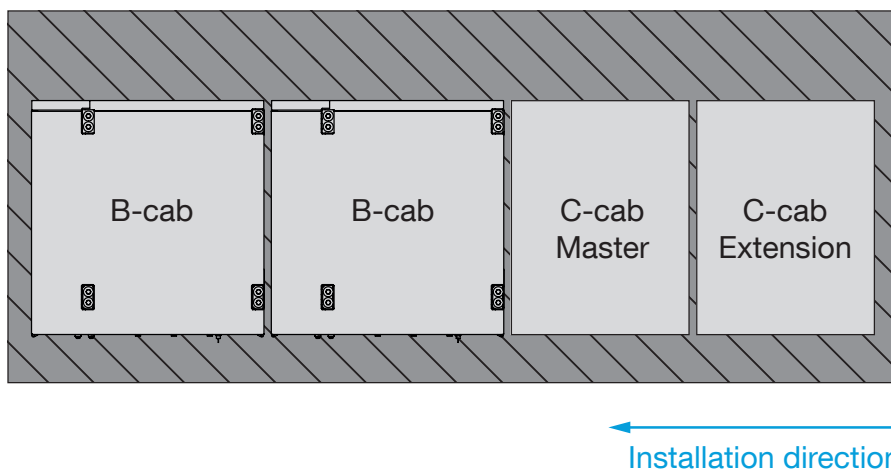


Figure 27. Cabinets order



WARNING!

The batteries have always to be installed on the left of the C-Cab, as shown above.

7.2. Marking of the C-Cab (only 1 C-Cab, no extension)

Two different drilling templates are available: one for the C-Cab and one for the B-Cab.

Mark the 4 holes shown below.



Figure 28. Holes to drill for 1 C-Cab installation

7.3. Marking of the B-Cab

Then prepare the B-Cab installation by measuring the distance between the C-Cab hole and the B-Cab hole (see below right figure), before drilling the holes. Pay attention to the mounting direction of the top and bottom template. The numbers must be legible upright.

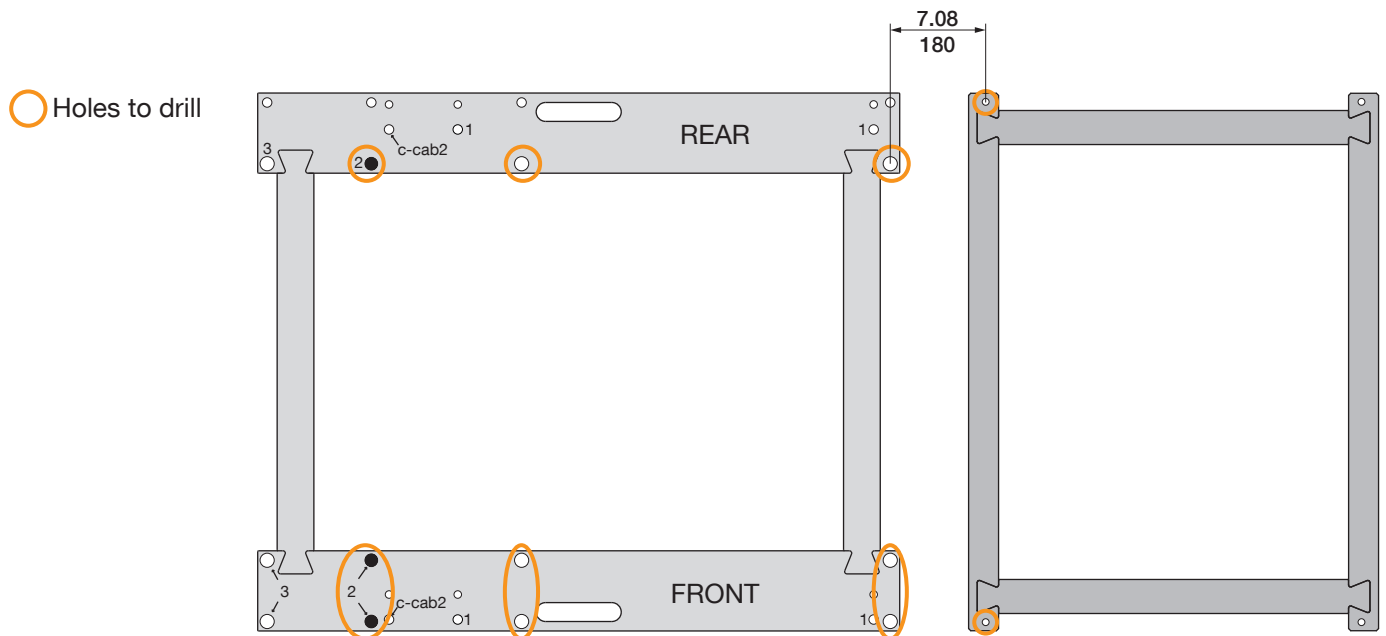


Figure 29. Holes to prepare B-Cab installation next to the C-Cab

If the battery is not the last one to be installed on the left side, you need to directly prepare the holes for the next battery, by marking 3 more holes as shown below.

If it is the last one, the marking is over.

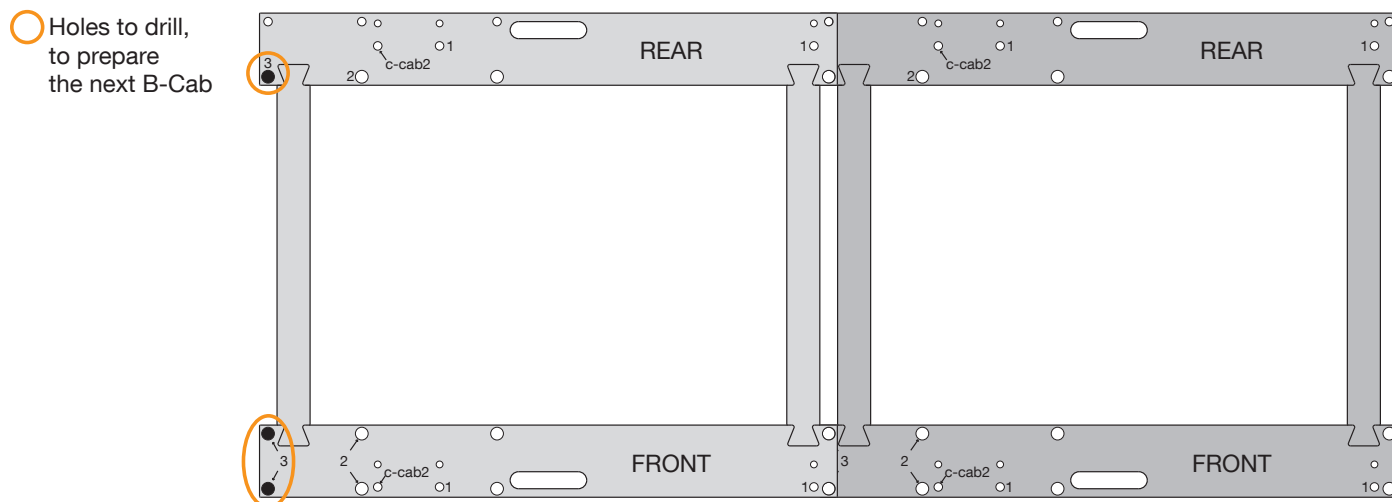


Figure 30. Holes to drill to prepare next B-cab installation

Move the drilling template kit and install it overlapping the 3 holes already drilled – note "2" – as shown below.

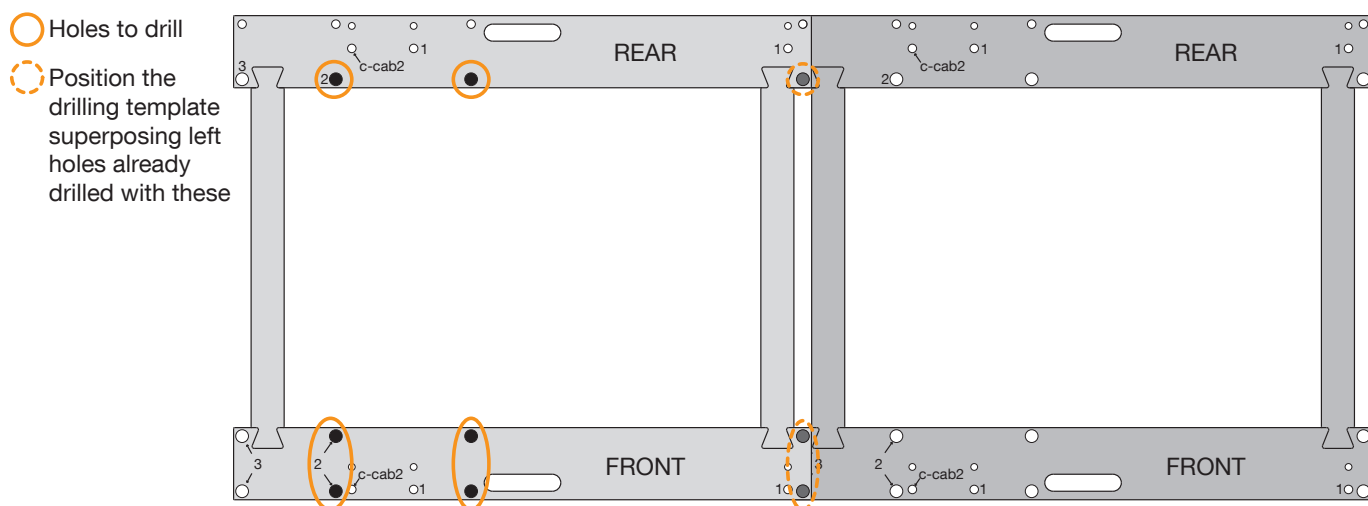


Figure 31. Holes to drill for the B-Cab installation

7.4. Installation with more than 1 C-Cab (one Master and one Extension)

Start from the cabinet on the right, position the drilling template of the C-Cab and mark the 4 holes (cf. chapter 7.2 page 40). Then put the drilling plate as shown below, keeping 462mm between the 2 holes, as shown below:

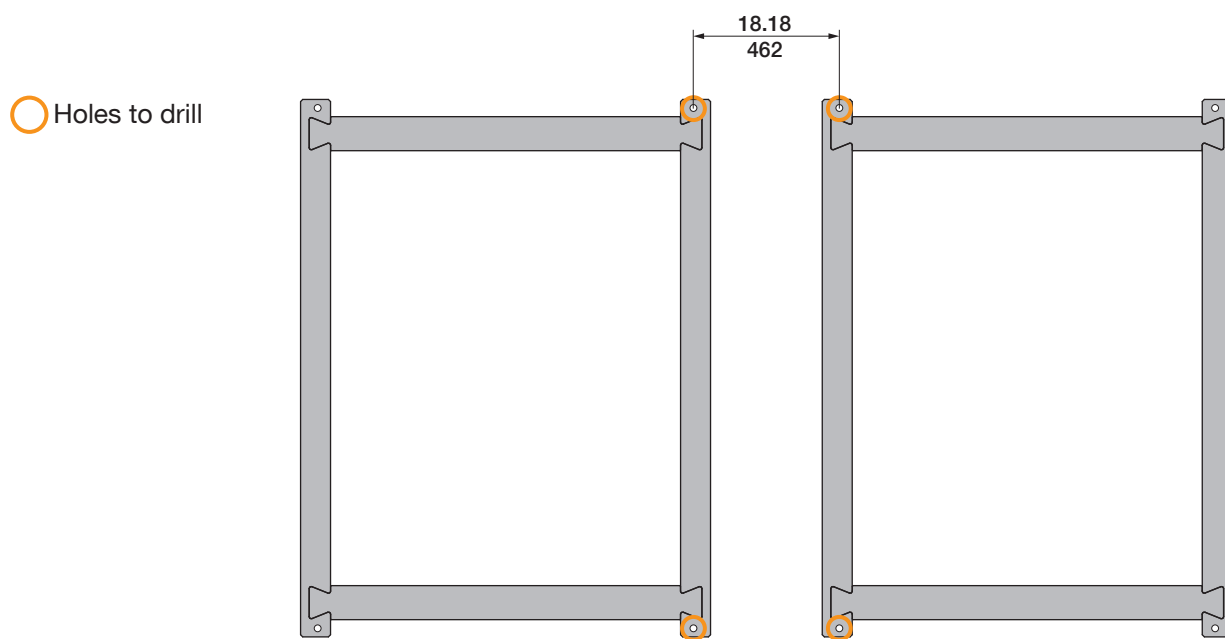


Figure 32. Holes to drill for the C-Cab installation

Then prepare the B-Cab installation (cf. chapter "7.3. Marking of the B-Cab", page 40).

7.5. Drilling

Drill all the holes marked:

- Dia M16 / 5/8 inch for the C-Cab and B-Cab

7.6. Putting cabinets in place

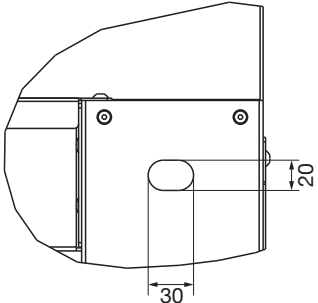
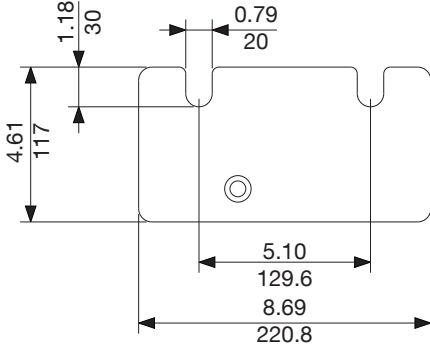
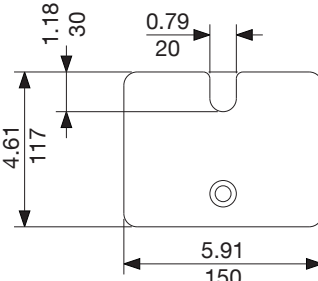
Before installing on the floor, level the floor using provided shims. Maximum allowed deviations must be in the following range: 2mm / 0.06in for vertical direction, plus/minus 7mm / 0.25in for horizontal direction (left to right), and plus/minus 7mm / 0.25in for horizontal direction (front to back).



Note: It is important for the unit to be leveled to ensure proper installation with the cable troughs from each battery cabinet.

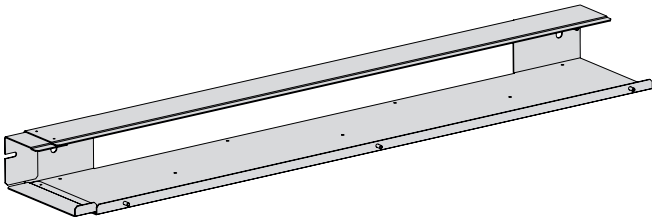
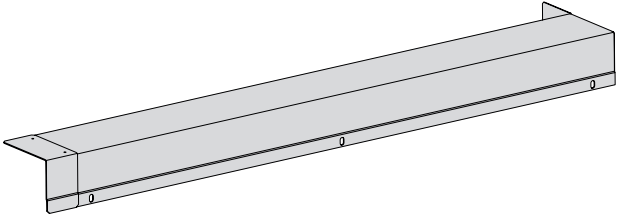
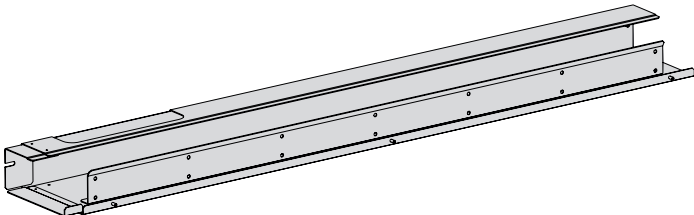
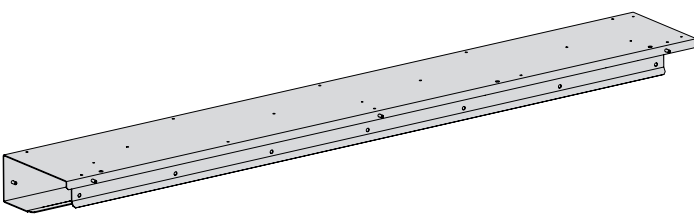
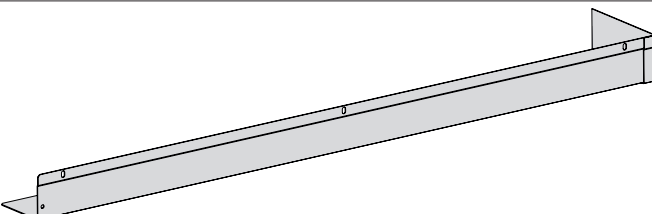
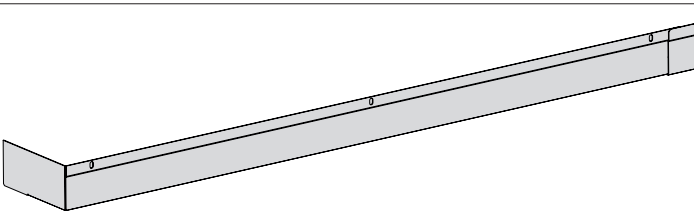
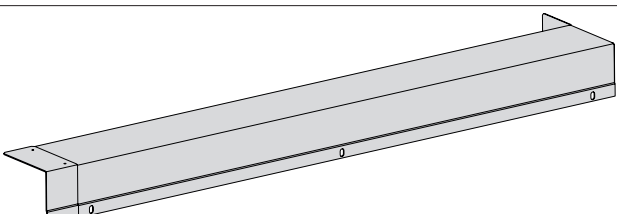
Put the cabinets in place, starting with the C-Cab on the right, and make sure to remove the side panels to have access to the bolts.

Once fixed with a 81Nm torque, put the side panels back, with a 8N.m torque. Then put the B-Cabs in place.

Cabinet	Fixing holes	Recommended screws size	Tightening torque
C-Cab		M16 / 5/8 inch	81 Nm/60 ft-lb
B-Cab		M16 / 5/8 inch	81 Nm / 60 ft-lb
			

8. CONNECTING KIT INSTALLATION

8.1. List of parts

Item 1	C-Cab connection kit – back part	
Item 2	C-Cab connection kit – cover part	
Item 3	B-Cab connection kit – middle and right back part	
Item 4	B-Cab connection kit – cover part	
Item 5	B-Cab connection kit – left back part	
Item 6	B-Cab connection kit – left cover part	
Item 7	B-Cab connection kit – right cover part	

8.2. Mounting details - To be continued

Once all cabinets are installed, shimmed (if necessary) and bolted to the concrete pad, you can install the connecting kit.

Step 1: Remove the front panel of the base of the C-CAB (DC-Cab and AC-Cab if applicable)

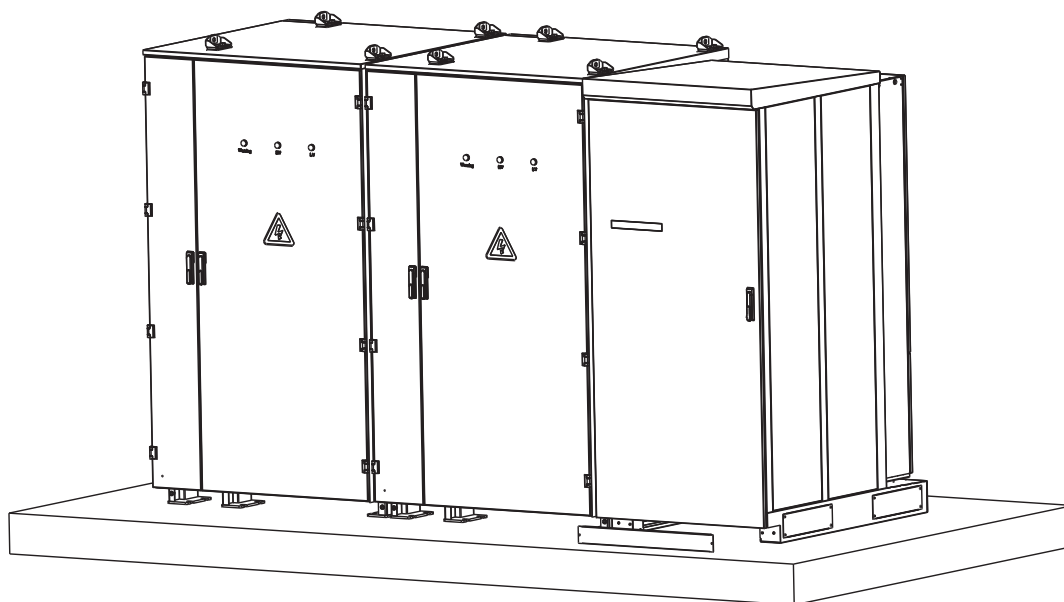


Figure 33. C-Cab front panel removal

Step 2: Place the C-Cab connection kit – back part, item 1, under the cabinet. Put it on top of the shims or directly on the concrete pad, whichever applies, and screw it on the cabinet with two screws M8, as shown below, with a torque of 15.2 Nm.

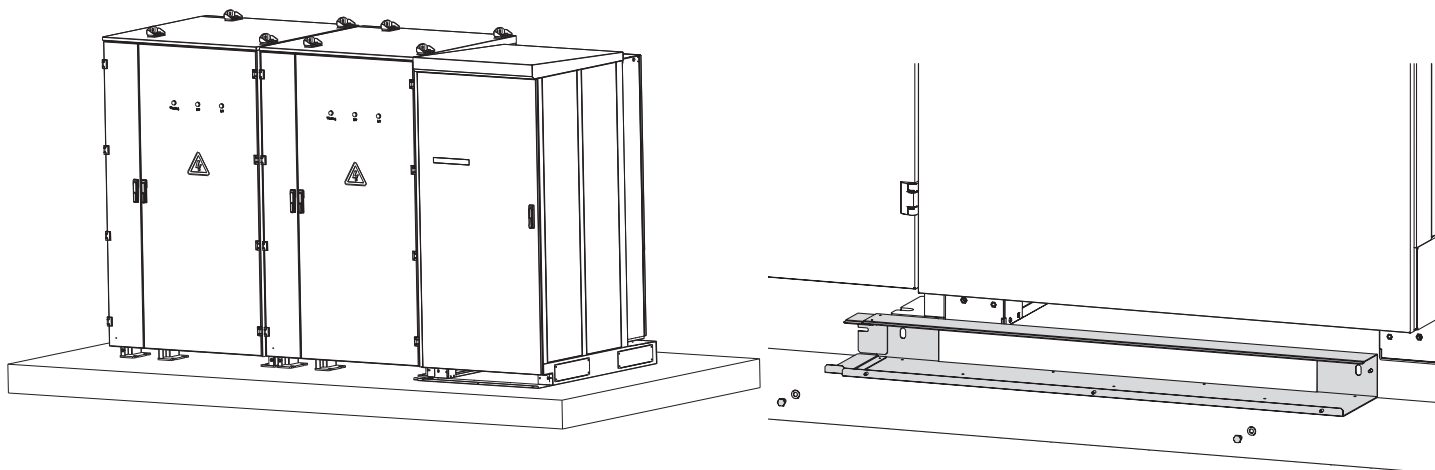


Figure 34. Installation of the back part of the C-Cab connection kit

Step 3: Place the B-Cab connection kit – back part, item 3, under every B-Cab. Put it on top of the shims or directly on the concrete pad, whichever applies, and screw every notch with stud M6 with a torque of 6Nm.

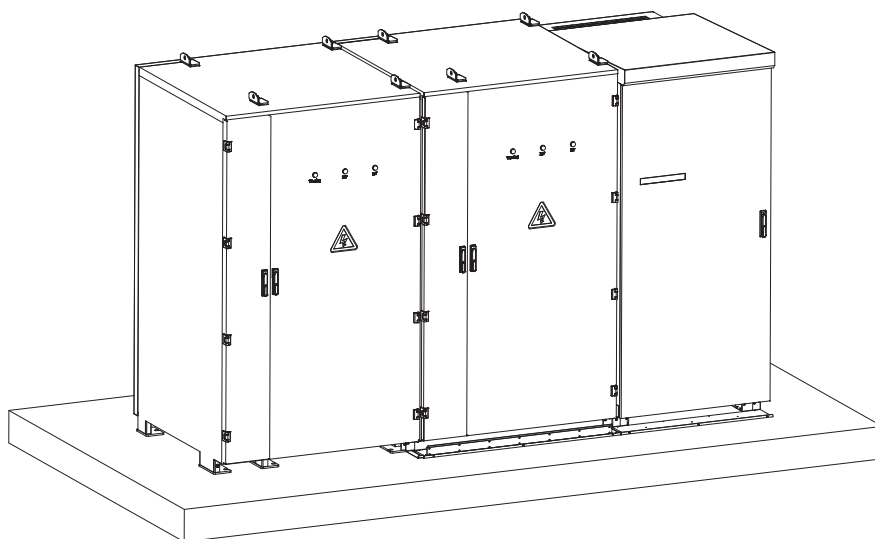


Figure 35. Installation of the B-Cab back part connection kit

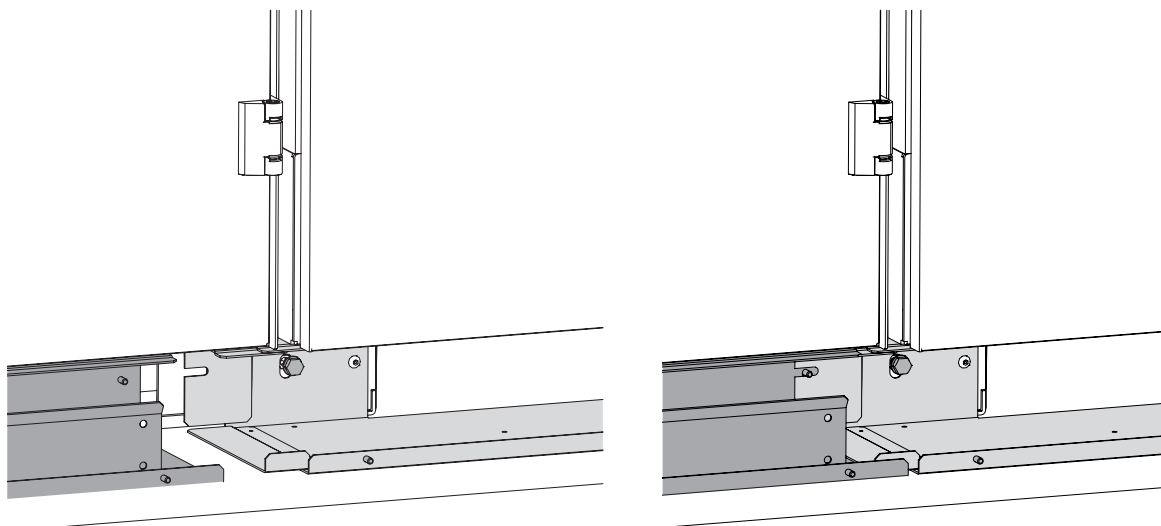


Figure 36. Connection of C-Cab and B-Cab parts

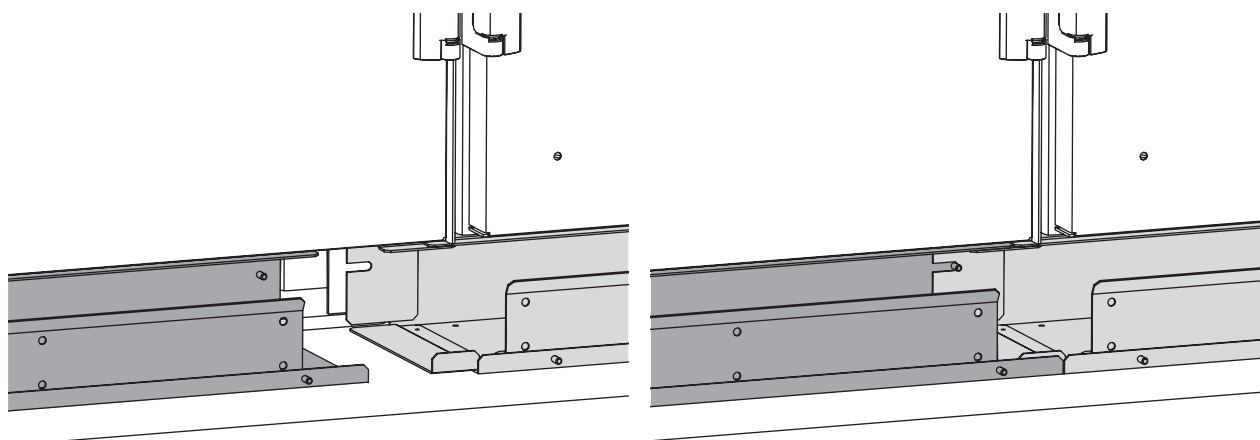


Figure 37. Connection of two B-Cab parts



Note: For the last B-cab of the front row, use item 5, left back part, instead of item 3.

Step 4: Lock in place all cable connection kits by using 1/4" Tapcon® bolts to secure them into the concrete floor in the 3 locations - through the shims (if they are present). Refer to Tapcon® for proper pilot hole sizes.

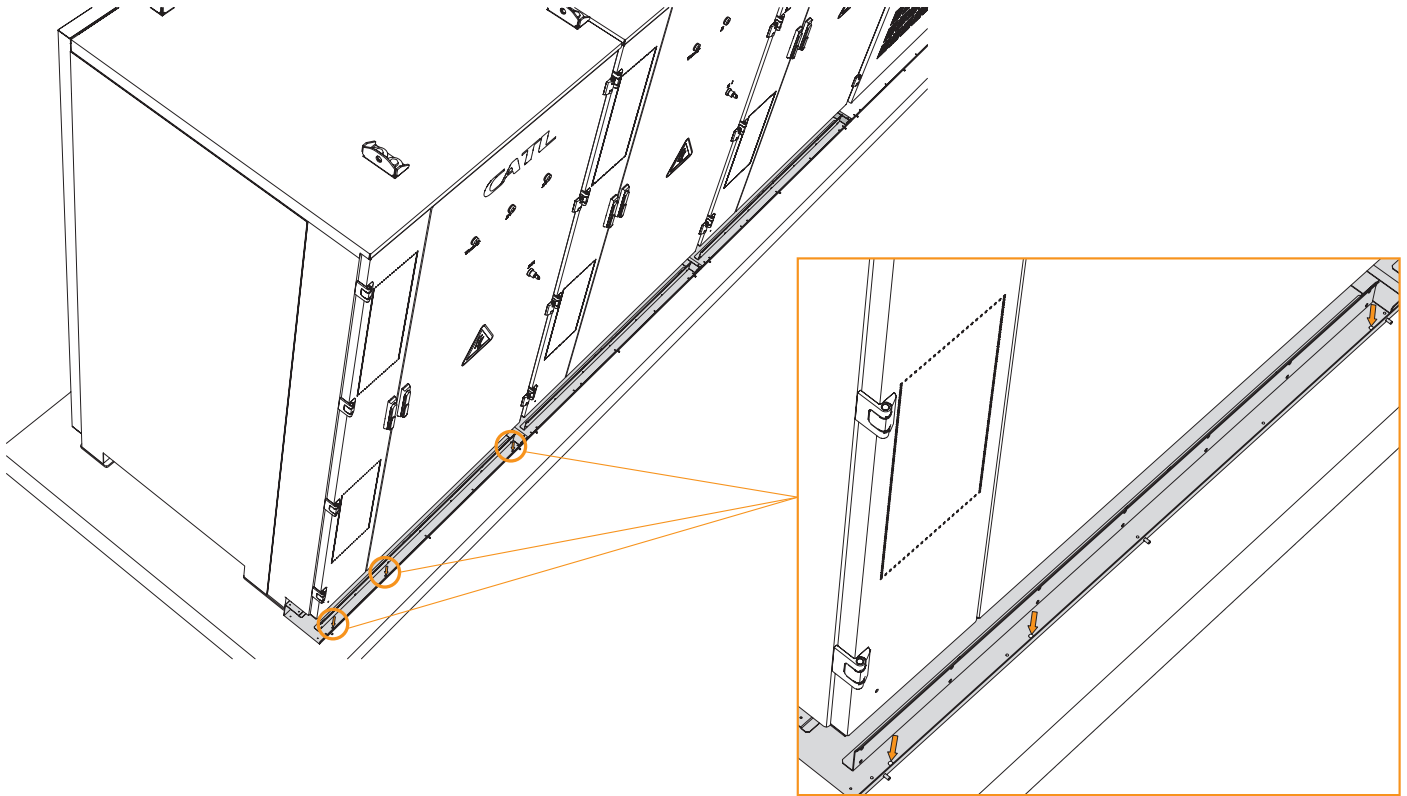


Figure 38. Cable connection kits locking

Step 5: Proceed with the wiring of the DC cables, the internal Ethernet communication and the battery communication cables and chiller and auxiliaries power supply cables. All these cables are supplied with the system.

Start from the C-Cab and connect the batteries from the nearest to the furthest. The details of the electrical connections will be found in the Electrical installation chapter.

Dimensions in/mm

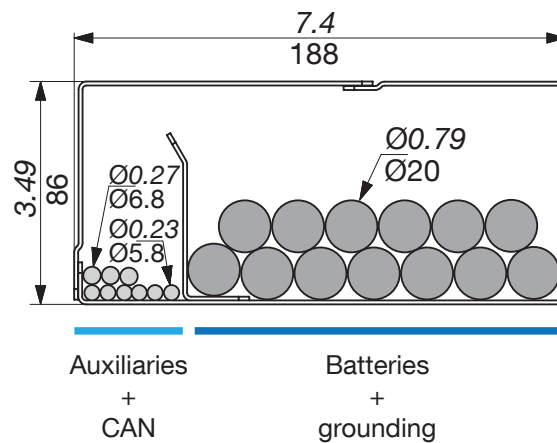


Figure 39. Cables organization inside the cable gutter

8.3. Electrical installation



FOR YOUR SAFETY: IT IS IMPERATIVE THAT ALL SOURCES OF POWER (AC & DC) ARE PROVEN DISCONNECTED BEFORE ANY WORK ON OR PHYSICAL CONTACT TO ELECTRICAL CIRCUITS IS ATTEMPTED.

DO NOT ASSUME BUT CHECK ACROSS THE LINES AND TO GROUND WITH A RELIABLE VOLTMETER AND ENSURE THAT THE SOURCE DISCONNECTION DEVICES ARE SECURELY LOCKED OUT.

THE MANUAL SWITCH DISCONNECT IN EACH BATTERY CABINET SHOULD BE IN THE OFF POSITION.

LOCK OUT AND TAG OUT PROCEDURES SHOULD BE FOLLOWED WHEN SERVICING THE EQUIPMENT.

Each battery cabinet is provided with an isolation switch QS to cut off the output of the batteries and breakers QF1 & QF2 (behind the cover) to cut off supply to chiller and controls of battery system. These switch & breakers are accessible from the control box located at left-hand side of each B-Cab. Additionally, each battery modules in the cabinet are provided with a Manual Switch Disconnect (MSD) for safety. Before proceeding to wiring, ensure that the isolation switch QS and the breakers QF1 & QF2 in the battery cabinets are in OPEN (OFF) position as illustrated after.

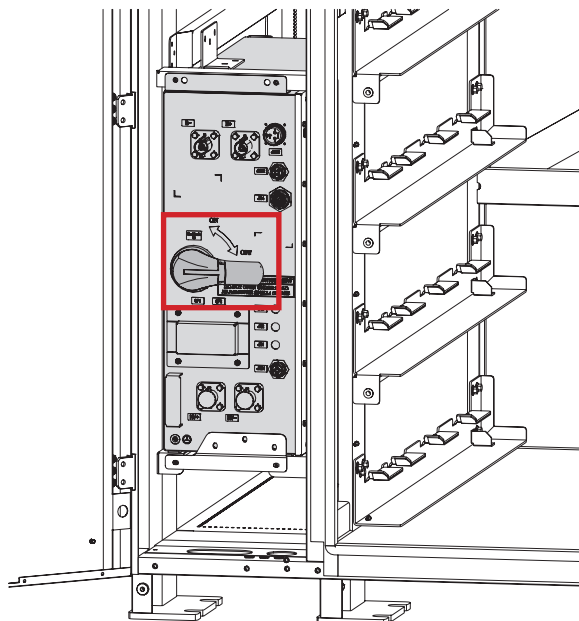


Figure 40. Location of isolation switch QS and breakers QF1 & QF2

The following pieces are already present in the C-Cab:

- Termination resistance for RS485 bus (X8 connector) - check chapter "8.3.4.3. Connections of automation box", page 69
- Cable bridge for B30 option between X9 and X10 - check chapter "8.3.4.3. Connections of automation box", page 69
- Cable bridge for Auxiliary power supply between X107 and X108 - check page 66 AC aux from user's UPS
- Cable between X3 (Automation Box) and X106 (Aux Interface Box)
- Ethernet cable between Eth10 (Automation Box) and Eth3 (Control Box) - check chapter "8.5.3. Communication Connection", page 76.

8.3.1. Battery Cabinet Interconnections

	DANGER! Risk of electrical shock including high short-circuit current as batteries are a source of electrical energy. Use only insulated tools around the modules and batteries and carefully avoid shorting the battery terminals or connections.
	CAUTION! Inadvertent short circuits are the major cause of failures for batteries. Risks associated with shorting as well as other hazardous conditions can be mitigated by carefully following the listed guidelines below.

Handling Precautions and Guidelines

- Wear appropriate Personal Protective Equipment (PPE) with due attention to eye protection in addition to insulated gloves.
- Remove all metallic objects from the person (e.g., Watches, jewelry, etc.) that could potentially contact the live battery terminals.
- All tools used around the battery assembly should be insulated or covered with, a non-conductive material.

The batteries require interconnections for DC power, auxiliary power, communication, and ground. The cables are provided for each connection and are labelled for ease of identification as they are of different lengths for each battery cabinet connections. Battery interconnections can be installed using the factory provided cable gutter.

8.3.2. Converter Cabinet Interconnections

On the following table there is an overview of the power connections of the C-Cab, including AC mains, DC connection, AC aux and the ground connection.

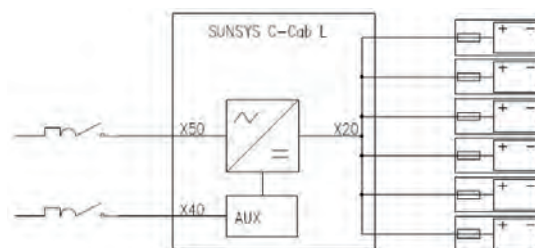
Description	Terminal ID	Max number of cables for each pole	Max cable section	Tightening torque	Termination type	Type of cable
DC connection	X20	6	95 mm2	70Nm / 52ft-lb	N°3 holes each bar (Ø13 mm)	>90°C copper wire
AC connection	X50	2	185 mm2			
		3	150 mm2			
		4	95 mm2			
Ground		1	185 mm2	40Nm / 29.5 ft-lb	N°2 screws M10 (Ø10 mm)	
		2	95 mm2			
AC auxiliary connection	X40	1	35 mm2	2.5Nm / 1.8ft-lb	Screw-in terminal block	
AC optional auxiliary connection	X107	1	2.5 mm2	N/A	Push-in terminal block	
CATL B-Cab power supply (voltage output)	B-CAB 1 ⋮ B-CAB 6	1	4 mm2			

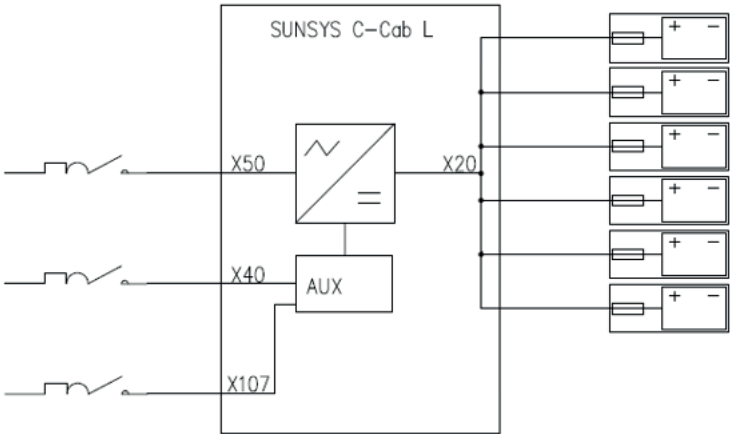
The electrical distribution panel must have a sectioning and protection system installed for each of the power inputs previously listed.

The tables below show the connection features and the size of the protection devices recommended for correct installation. See the schematics for an overview of the possible configurations.

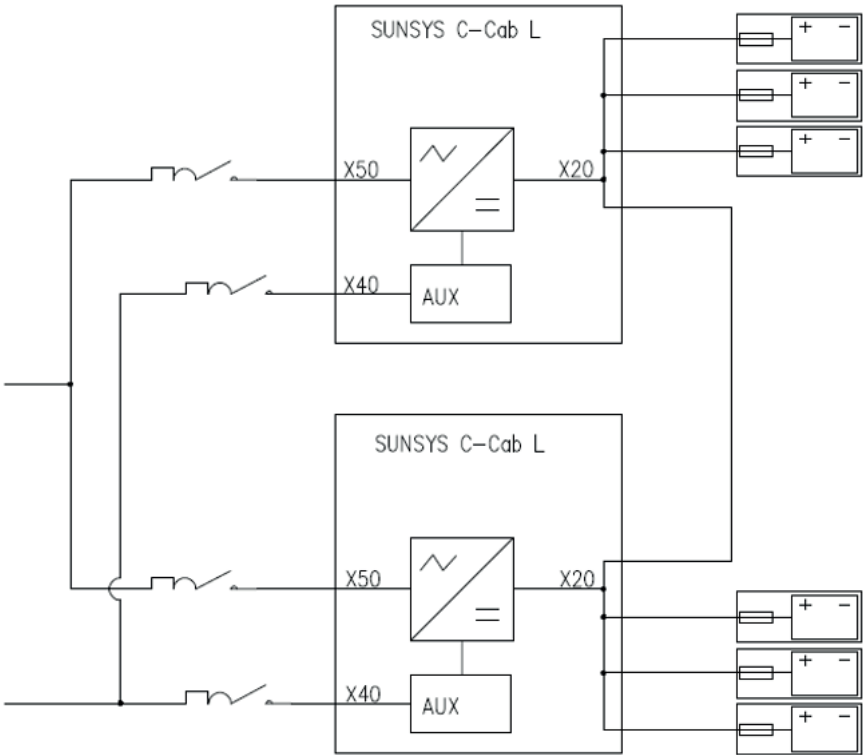
In the “Power cables connection” section is described the position of each connection point and the safe procedure to connect the cables.

Protection of single C-Cab

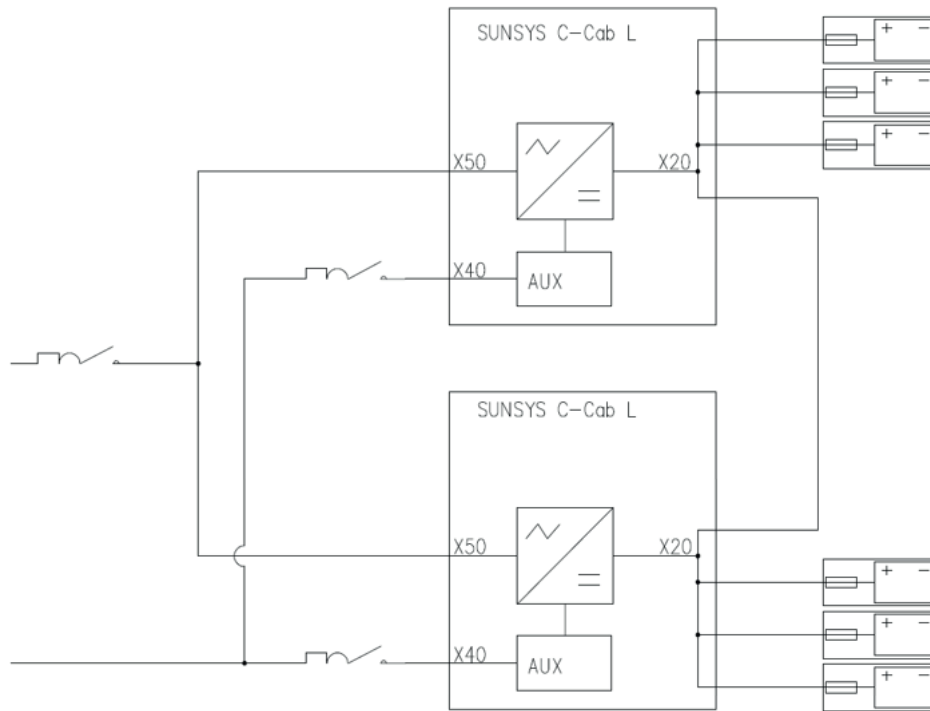




Protection of 2 C-Cabs with 2 separated AC protections (suggested)



Protection of 2 C-Cabs with common AC protection (allowed)



The installation and system must comply with national plant regulations.

The electrical distribution panel must have a sectioning and protection system installed for input and auxiliary mains.

Size of AC input protection

Type of system	Rated AC voltage	System power	Overcurrent protection rated current				Maximum short circuit current
			Size	Circuit breaker type		RCD* (Residual Current Device)	
				Vout 400V	Vout 380V		
Single C-Cab	400 V 3 ph+N 50Hz	50 kVA	90 A	D	C	0.5 A Type “B”	50 kA
		100 kVA	180 A	D	C		
		150 kVA	270 A	D	C		
		200 kVA	360 A	D	C		
N°2 C-Cabs in parallel	400 V 3 ph+N 50Hz	250 kVA	450 A	C	C		
		300 kVA	540 A	C	C		
		350 kVA	630 A	D	C		
		400 kVA	720 A	D	C		

*AC side RCD is not allowed for TN-C systems and not mandatory for TN-S systems.

Size of DC input protection – if you are not using our provided cabling kits

Type of system	DC Voltage range	System power	Overcurrent protection rated current	Maximum short circuit current	Maximum let-through energy
Single C-Cab	570 V ÷ 860 V	50 kVA	100 A	100 kA	1.4 MA²s
		100 kVA	200 A		
		150 kVA	300 A		
		200 kVA	400 A		
		250 kVA	500 A		
		300 kVA	600 A		
N°2 C-Cabs in parallel	570 V ÷ 860 V	350 kVA	700 A		
		400 kVA	800 A		

Size of AC auxiliary input protection				
Auxiliary rated voltage	Number of B-Cabs	Overcurrent protection rated current	Circuit breaker type	RCD
400 V 3 ph+N 50Hz	0	16 A	D	0.03A Type «A»
	1	32 A	C	
	2	32 A		
	3	32 A		
	4	50 A		
	5	50 A		
	6	50 A		

Optional “Control auxiliary port” Connector X107 Size of protection		
Auxiliary rated voltage	Required overcurrent protection	Circuit breaker type
100÷250 V 1 ph+N 50/60 Hz	8 A	C

8.3.2.1. Power cables connection

	WARNING! Cable glands must not be removed during the normal function of the product; use only the cable glands provided with the C-Cab for the installation.
	Make sure that all the glands are in place and that no hole remains uncovered after the installation of cables

In order to access the terminals for the connection of cables, unscrew the 6 screws and remove the plastic panel protecting the connection area in front of the terminals.

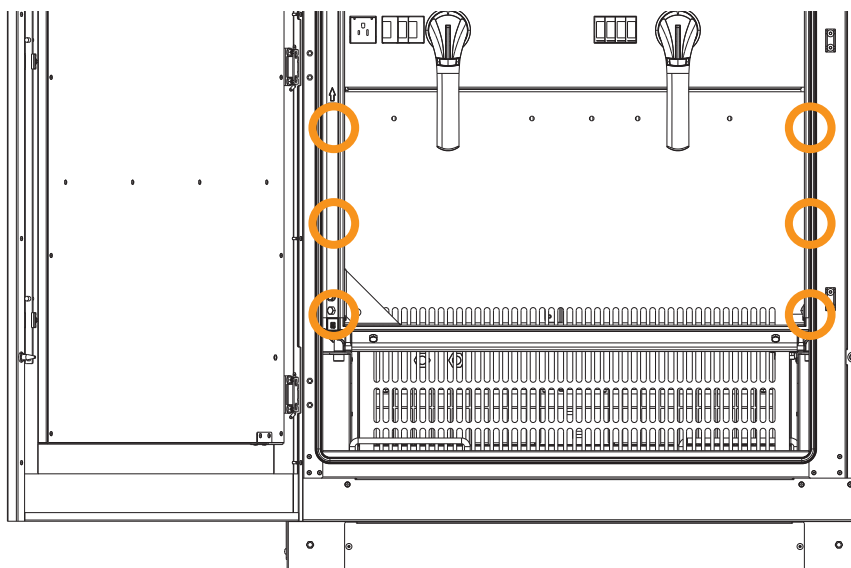
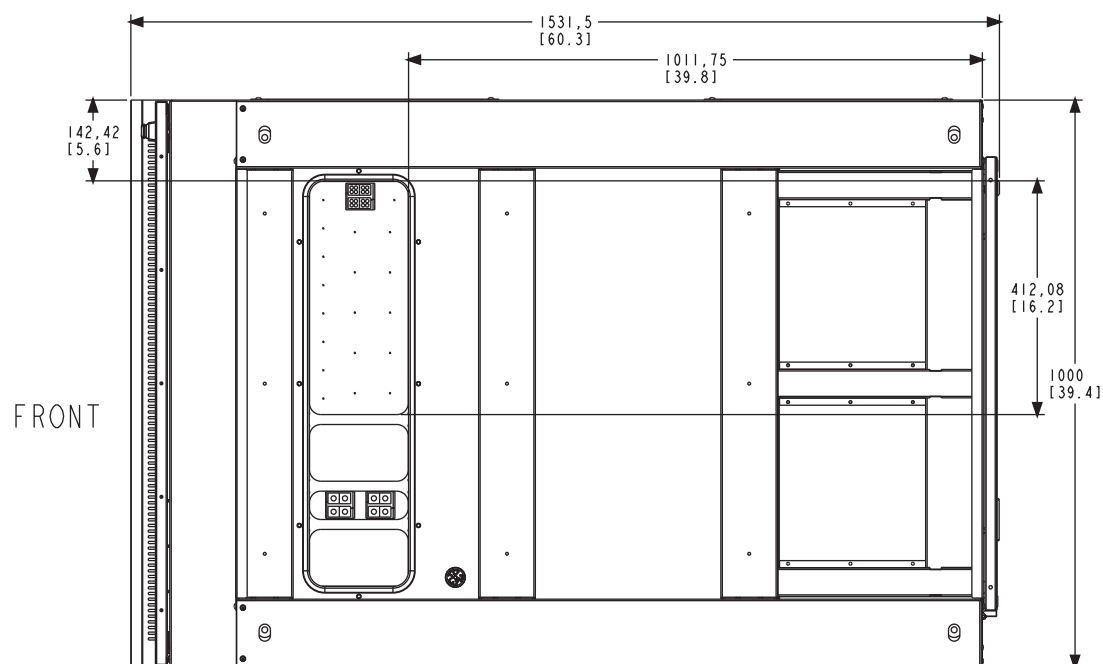


Figure 41. Screws of the plastic panel

The bottom part of the machine is provided with 4 metal plates that are used for the passage of cables. This part is located inside the C-Cab as shown on the below figure:



In order to grant the IP55 protection of the cabinet, the cables have to be installed following the instructions in the present manual.

3 cable glands are provided for the passage of small cables; the cable glands for power cables are not installed by default and it is necessary to drill the plates with the required number of holes according the layout of the installation.



Note: ensure that the cabling is not under excessive stress and not pressing any sharp edge or adjacent terminal; adjust and strap/lace in place as required.

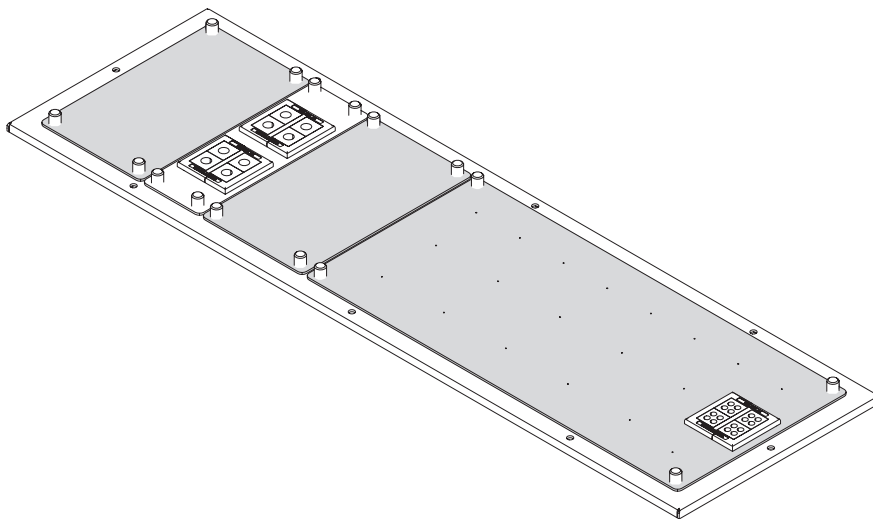
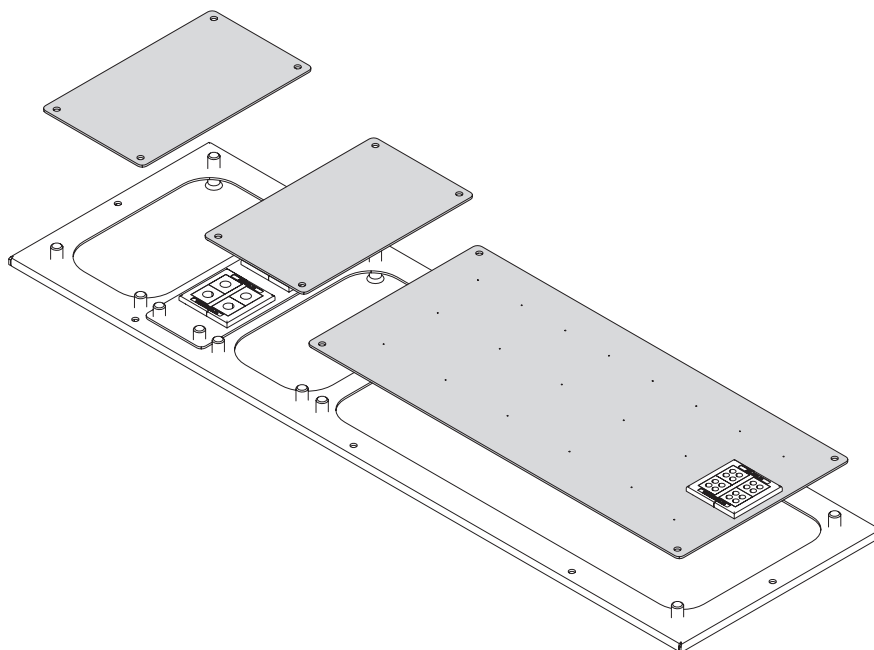


Figure 42. Cable glands plates

To install the power cables, follow the procedure below:

- 1) Remove the 3 plates from the bottom



- 2) Drill the holes on the plates. See the layout suggested later on this chapter.

- 3) Insert the Nema 3R/IP55 glands (not delivered) in the holes

- 4) Put the plates back in place and fix them to the baseplate

- 5) Start to fix the cables

For each cable, follow this procedure:

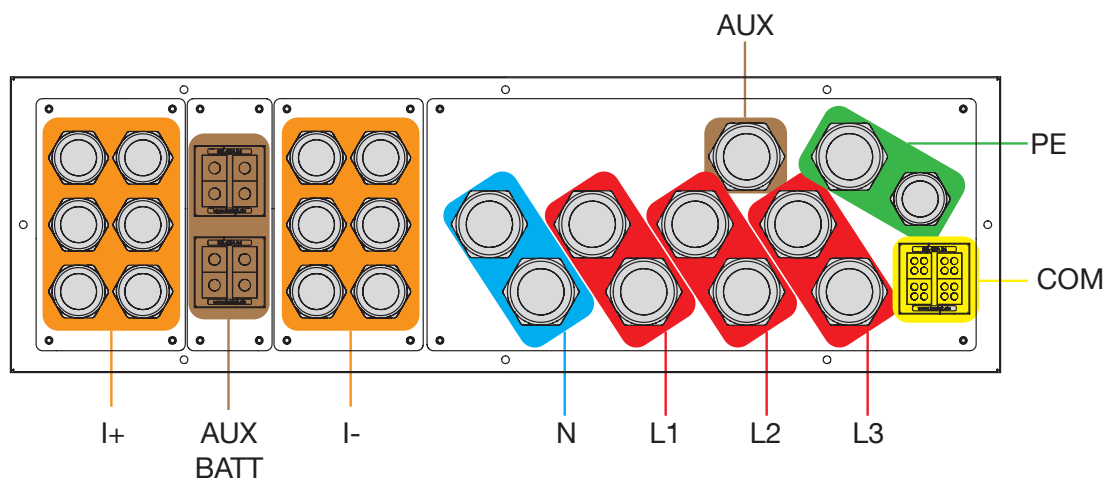
- A) insert the cable inside the cable gland
- B) fix the cable to the power terminal
- C) fix the gland with the proper torque

Apply this procedure starting from the rear row of cables and proceeding to the front.

- 6) After the connection of all the cables (described in the present chapter), re-close the plastic panel with his 4 screws.

- 7) Make sure that all the cable glands are in place and properly fixed in order to grant the IP55 protection of the system.

Suggested layouts for cable glands positioning:



In case of systems above 300kVA, so meaning made of C-Cabs composed of more than 1 unit, the AC connection needs to come from the grid to both C-Cabs (each one with one connection, see chapter 8.5.2). In this case additional metering devices are required, please contact Socomec team to help you determine what is requested.

8.3.3. AC, DC and ground connection

Power AC, DC and Ground terminals

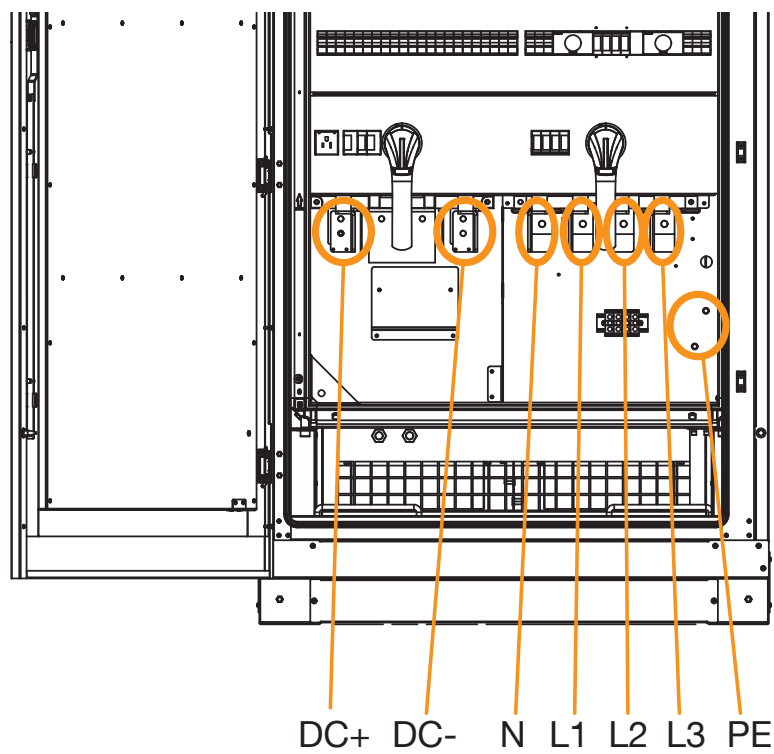


Figure 43. Power and ground connections

Terminal block	Terminals	Description
X50	L1 L2 L3 N	Connection terminals for the main AC network
X20	L+ L-	DC connection terminals for the batteries
	PE	Connection terminal for the protective earth wire



CAUTION!
 Failure to observe grounding procedures may lead to the risk of electrical shock, or the risk of fire if a ground fault occurs.
 Remember to connect the ground at the marked point .
 Ground connections must be in compliance with local regulations and applicable standards.



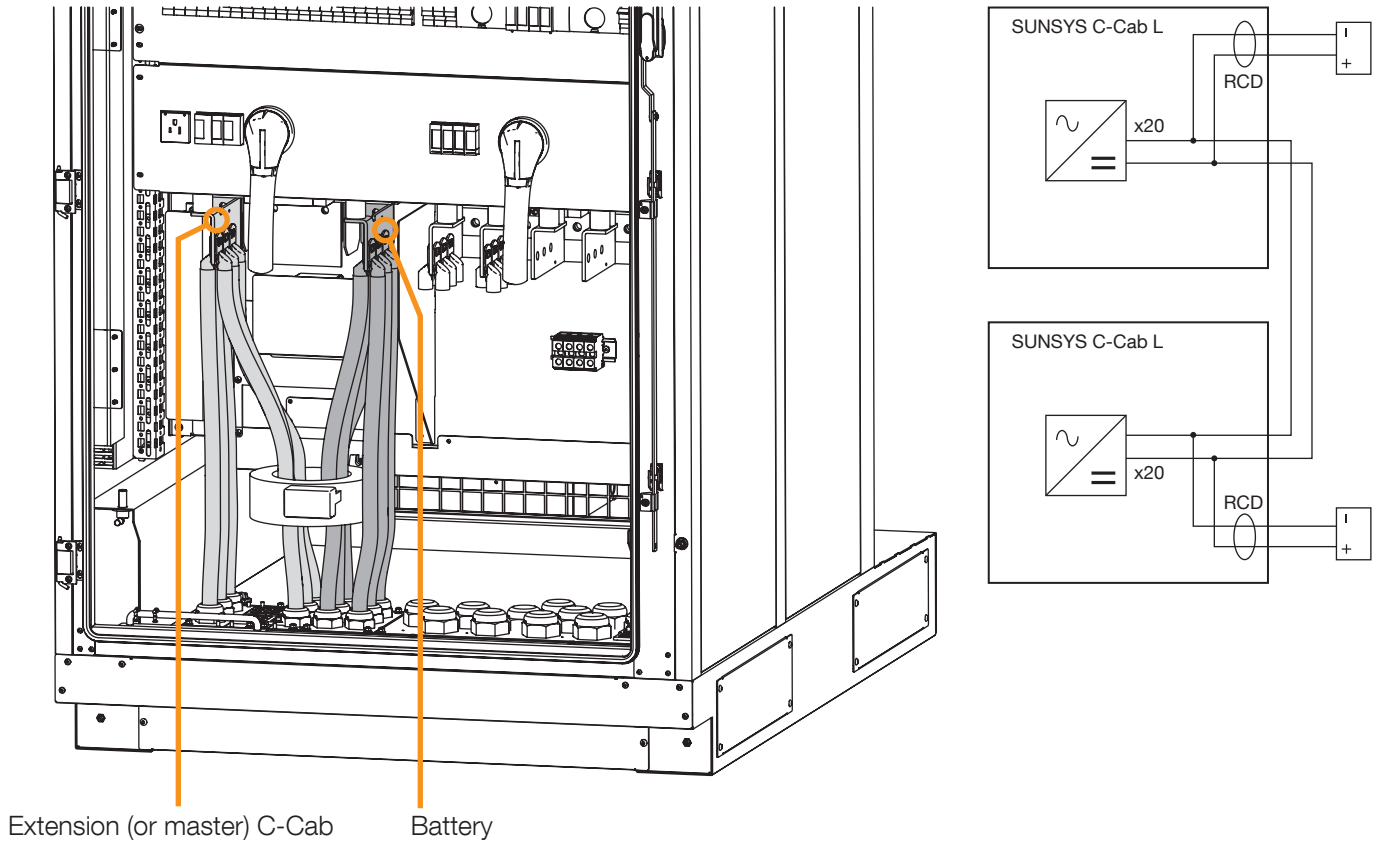
Note: the L1, L2 and L3 wires shall be connected respecting a **clockwise phase rotation**, i.e. L1 anticipates L2 and L2 anticipates L3. Some utilities may adopt a counterclockwise phase rotation as standard, so the names or colors indicated on the cables may not match the names indicated on the C-Cab AC bars.
 Verify the actual phase rotation before connecting the AC cables.

AC Power Neutral connection			
Type of connection	Pure on-grid	Pure off-grid	Mixed on-grid/off-grid
Neutral connection	Not required	Required with 4 wires load	Required with 4 wires load

8.3.4. RCD positioning for systems composed of 2 C-Cabs (1 Master and 1 Slave)

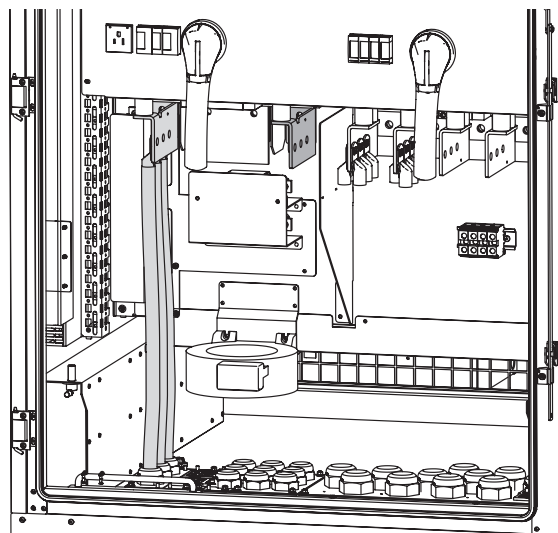
If the system is composed of 2 C-Cabs in parallel, one master and one slave, the RCD will be installed in the bottom part of each cabinet, below the copper bar connections.

The cables that are connected to the battery (both positive and negative poles) shall pass through the RCD current transformer, while the cables connected to the other C-Cab shall pass outside the current transformer. This allows to detect a fault on the battery in order to protect the battery itself.

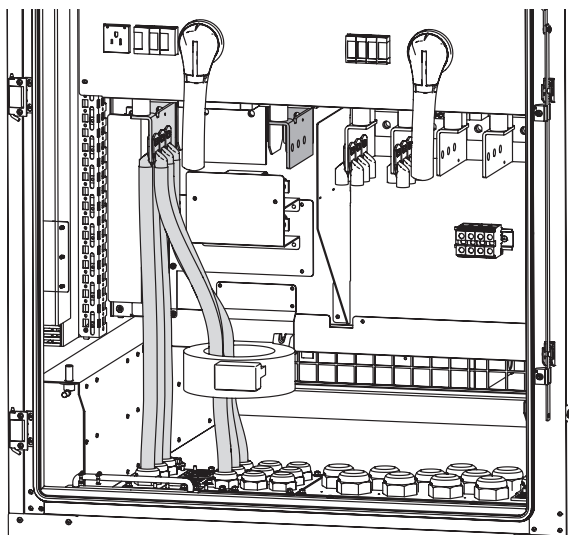


In order to allow an easier installation of the cables, start fixing the cables from the left to the right. Take care that the cables do not press too hard against the plastic of the component. Pay attention not to damage the cable connected to the RCD component during the installation.

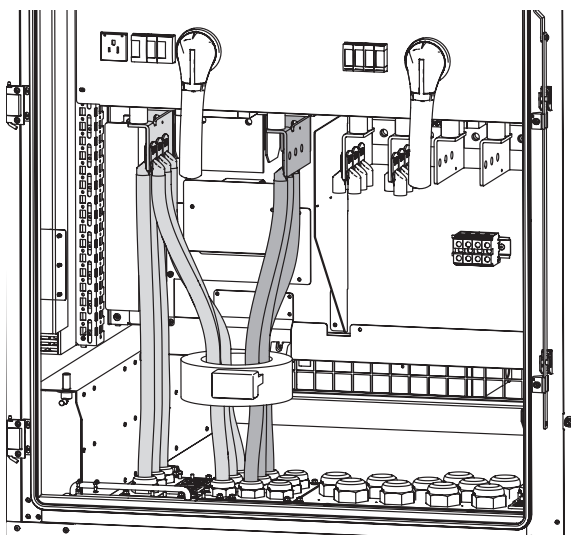
- Connect and fix the first parallel cables on the left (up to 3 cables):



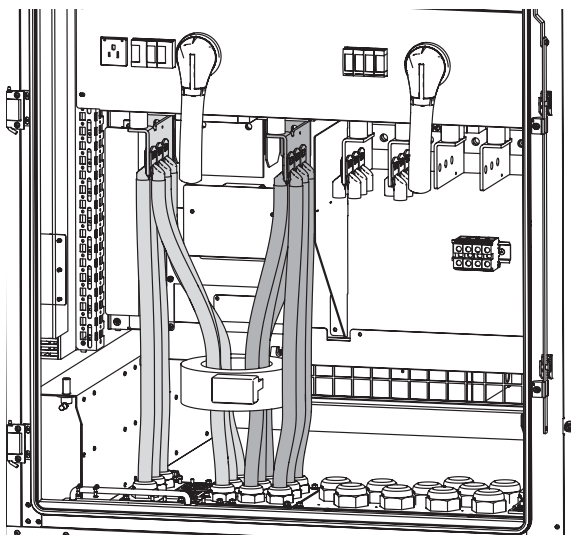
- Put in position the battery cables (up to 6) and pass the RCD around the battery cables; Fix the RCD with its bracket to the rear panel:



- Connect and fix the battery cables to the bars; take care that the cables do not press too hard against the plastic of the component.
- Fix the last parallel cables on the right side (up to 3 cables).



Connect the signal cable of the RCD.



8.3.4.1. DC Power Connections

1 - For the first B-Cab

- a. Open both cabinet doors and remove the dead front from the termination compartment.
- b. Identify the cable for positive power connection.
- c. Lay the cable on the ground in front of the cable gutter with the orange connector at the B-Cab and other end trailing over to the termination compartment.
- d. For the B-Cab, route the cable end with the orange connector through the bottom hole in the gutter and the B-Cab access hole.
- e. Plug in the connector to HV+ terminal by completely pushing into the receptacle while pressing the secondary lock (red) inwards to secure the connection. Ensure the connection is fully locked in place by pulling on it.



Note: the HV connector is not installed correctly if the secondary lock cannot be pushed in.

- f. For the termination compartment, route the other end of the cable up from the gutter opening into the bottom of the termination compartment while laying the cable into the rear of the gutter.



Note: ensure the cable is laid straight without any excessive slack.

- g. Connect to the positive terminal and bolt using the provided hardware and torque.
- h. Identify the cable for negative power connection.
- i. Lay the cable on the ground in front of the cable gutter with the black connector at the B-Cab and other end trailing over to the termination compartment.
- j. For the B-Cab, route the cable end with the black connector through the bottom hole in the gutter and the B-Cab access hole.
- k. Plug in the connector to HV- terminal by completely pushing into the receptacle while pressing the secondary lock (red) inwards to secure the connection. Ensure the connection is fully locked in place by pulling on it.



Note: the HV connector is not installed correctly if the secondary lock cannot be pushed in.

- l. For the termination compartment, route the other end of the cable up from the gutter opening into the bottom of the termination compartment while laying the cable into the rear of the gutter.



Note: ensure the cable is laid straight without any excessive slack.

- m. Connect to the negative terminal and bolt using the provided hardware and torque.

2 - In like manner, repeat the above procedure for each battery cabinet using the appropriate table to identify the cable sets for each cabinet cable run.

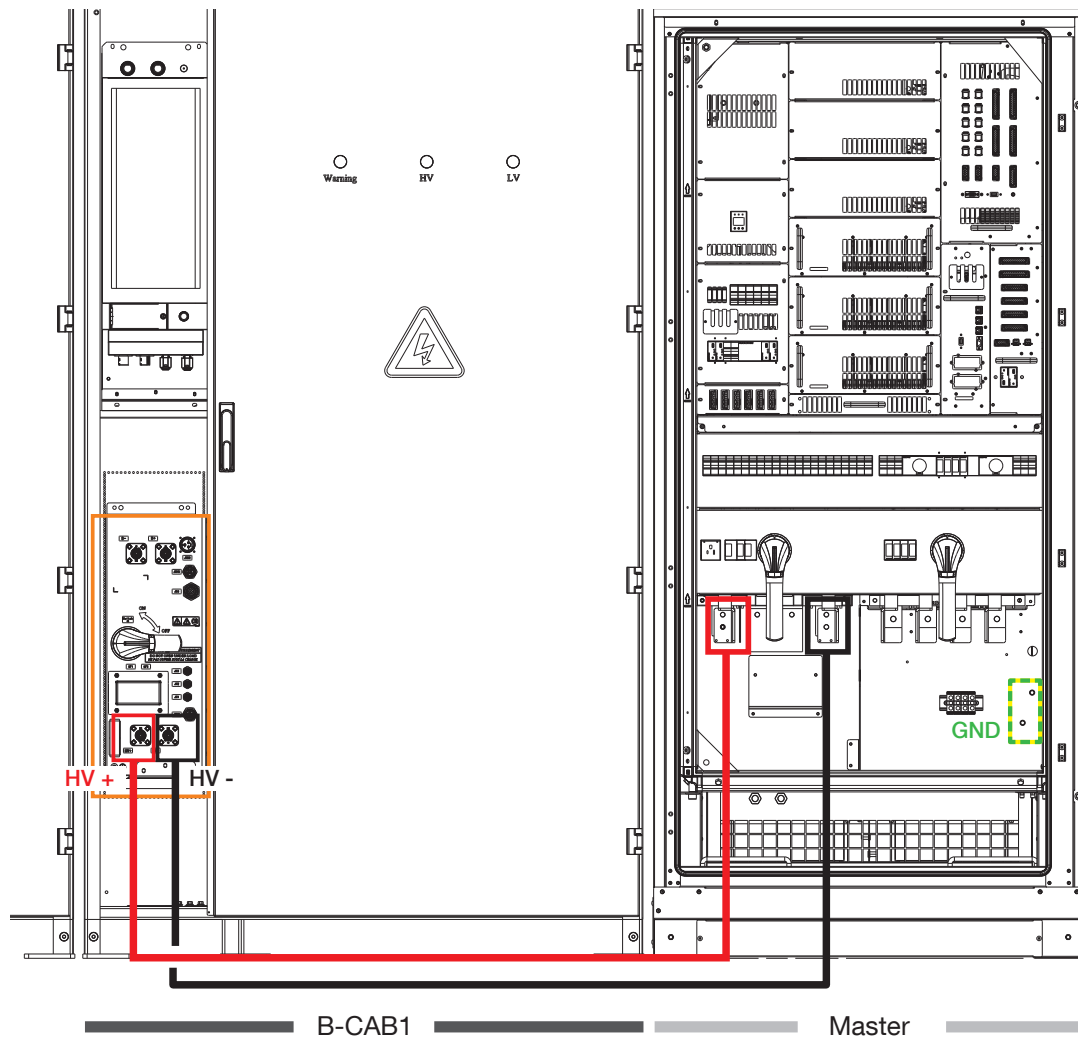


Figure 44. DC Power connections

8.3.4.2. Grounding



CAUTION!

Failure to observe grounding procedures may lead to the risk of electrical shock, or the risk of fire if a ground fault occurs.

Remember to connect the ground at the marked point

Ground connections must be in compliance with local regulations and applicable standards.

The AC output circuits are isolated from the enclosure and from the grounding.

Grounding is used for equipment and personnel safety. The SUNSYS HES L Marine is designed to operate with 3-wire and 4-wire grounded sources and is compatible with solidly grounded or resistance grounded systems, specific option depending on your requirements. All input and output power feeds must include an equipment grounding means as required by the local codes.

The equipment ground conductors should be sized based on the upstream overcurrent protection per code and connected to the sole Ground Terminal.

The ground connection cross-section must be at least equal to the half of one phase cross-section.

The following instructions describe the method of routing ground cables from each B-Cab to the termination compartment, these are supplied by Socomec. In the instructions below, B-Cabs are referred relative to their position from the C-Cab.



WARNING!

Ensure that there is no power applied to the unit

Ensure the isolation switch QS and the breakers QF1 & QF2 in each battery cabinet are in OPEN position

Ensure all MSD covers in each battery cabinet are not installed

1. Check with a reliable voltage indicating device that both DC and AC terminals in battery and termination compartments have close to zero potential.

2. For the first B-Cab,

- Lay the cable on the ground in front of the cable gutter between the B-Cab and the termination compartment.
- For the B-Cab, route one end of the cable through the bottom hole in the gutter and the B-Cab access hole.
- Connect to the ground terminal and bolt using the provided hardware and torque.
- For the termination compartment, route the other end of the cable up from the gutter opening into the bottom of the termination compartment while laying the cable into the rear of the gutter.



Note: ensure the cable is laid straight without any excessive slack.

e. Connect to the ground terminal and bolt using the provided hardware and torque.

3. Then, connect the ground from B-Cab 1 and B-Cab 2, then B-Cab 2 to B-Cab 3... in a daisy chained manner.

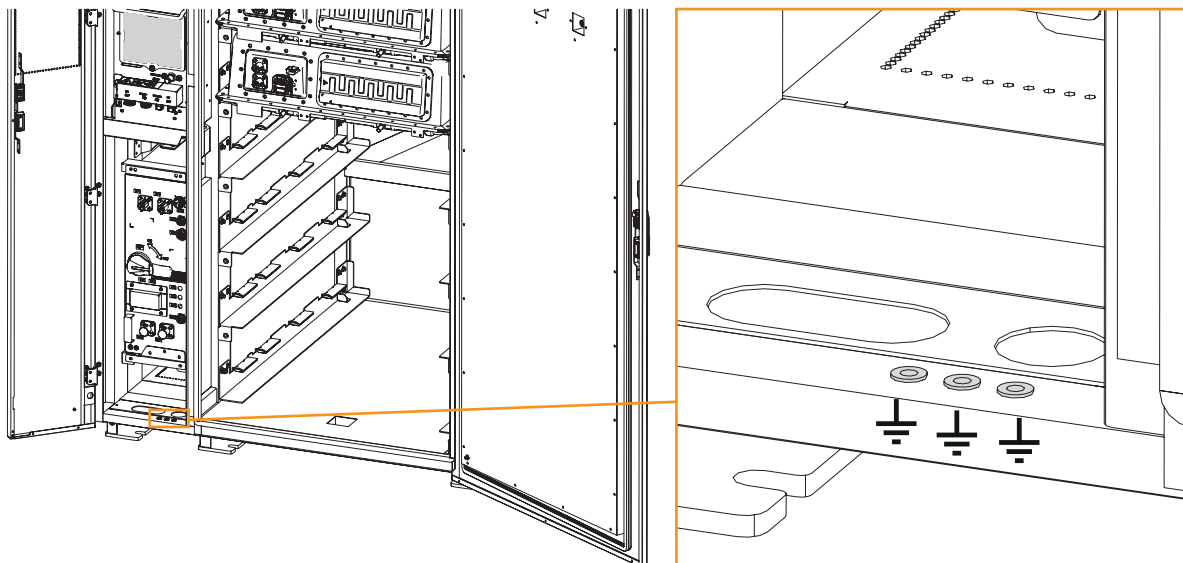


Figure 45. Battery cabinet ground terminal

8.3.4.3. AC Power connections

Due to the reduced height of base we recommend a connection through a sleeve directly under the cabinet for the AC connections.

Concerning the AC connection, refer to Figure 50, there is enough space inside the C-Cab to connect up to $2 \times 185\text{mm}^2$ / $2 \times 350\text{MCM}$ on each pole. The lugs needed are M12.

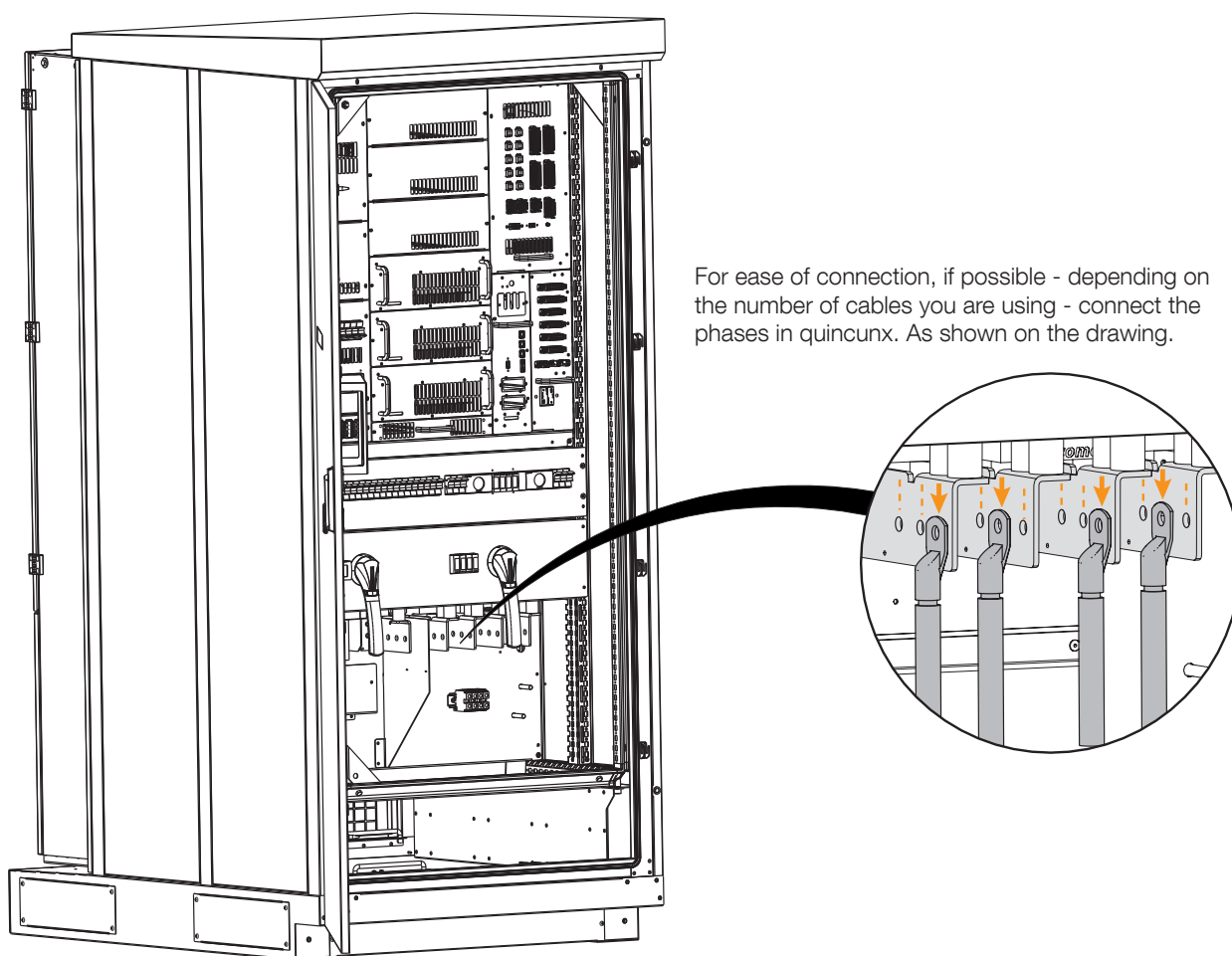


Figure 46. AC power connections positioning



Note: before connecting this power cables, connect the AC aux connection, see following chapter.

8.3.4.4. Auxiliary power connection

Auxiliary terminals

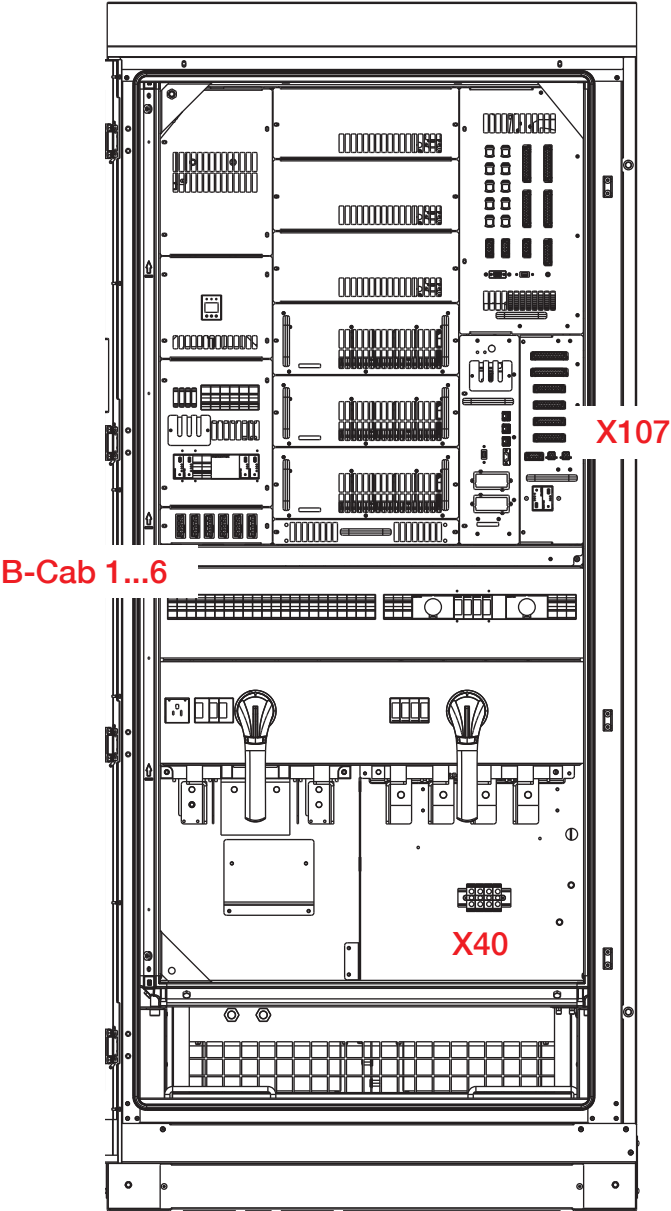


Figure 47. Location of the auxiliary connections in the C-Cab

Terminal block	Terminals	Description
X40	L1 L2 L3 N	AC auxiliary connection
X107	See AC aux from user's UPS - below	AC optional auxiliary connection
B-CAB 1 ÷ B-CAB 6	See B-Cabs aux power supply - below	CATL B-Cab power supply (voltage output)

AC aux connection

Fix the wires L1, L2, L3 and the neutral to the connection terminals. Voltage should be 400Vac Ph-Ph, 50Hz.

The maximum possible size of the cables is 35mm². It is also the minimum in case of 6 B-cabs.

Note: the L1, L2 and L3 wires shall be connected respecting a **clockwise phase rotation**, i.e. L1 anticipates L2 and L2 anticipates L3. Some utilities may adopt a counterclockwise phase rotation as standard, so the names or colors indicated on the cables may not match the names indicated on the C-Cab AC bars.
Verify the actual phase rotation before connecting the AC cables.

WARNING!
Auxiliary supply should not be directly connected on AC power connection. Voltage tolerance and overvoltage category must be considered carefully.

B-Cabs aux power supply

The SUNSYS C-Cab L Marine is provided with 6 connectors that can supply the auxiliary power to the B-Cabs.

Each connector has two lines that provide power to the HVAC system and to the electronic of a single B-Cab. Do not connect more than 1 B-Cab per connector.

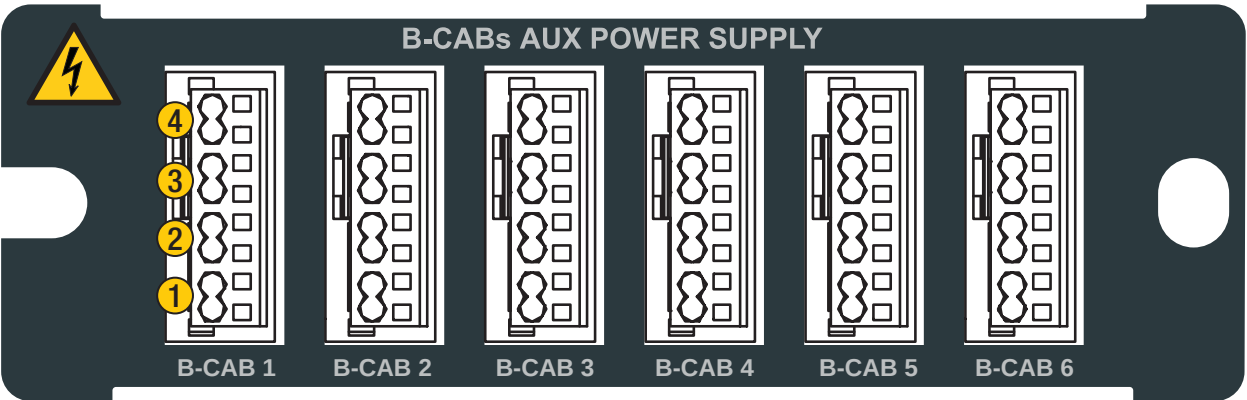


Figure 48. C-Cab connector for B-Cabs aux power supply

Pin	Function
①	HVAC supply
②	
③	Aux supply
④	

Shall you have only a master C-Cab or a master + extension C-Cab, all the connections will come from the master C-Cab.

From C-Cab Master « B-Cab Aux power supply connectors »	To (B-Cab)
B-CAB 1	JXH1 of B-Cab 1
B-CAB 2	JXH1 of B-Cab 2
B-CAB 3	JXH1 of B-Cab 3
B-CAB 4	JXH1 of B-Cab 4
B-CAB 5	JXH1 of B-Cab 5
B-CAB 6	JXH1 of B-Cab 6

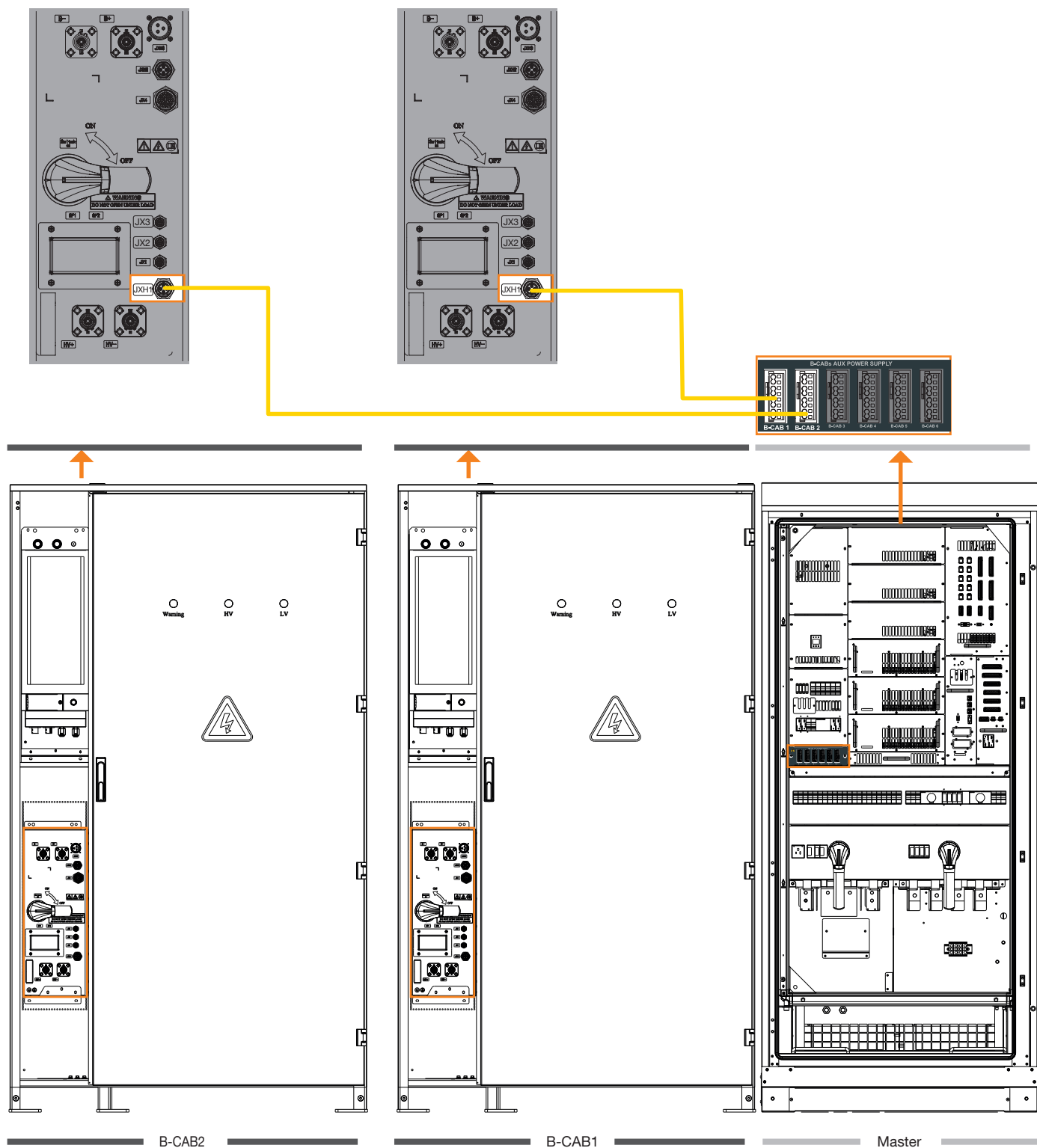


Figure 49. Connection of the B-Cabs aux power supply from the C-Cab

AC aux from user's UPS

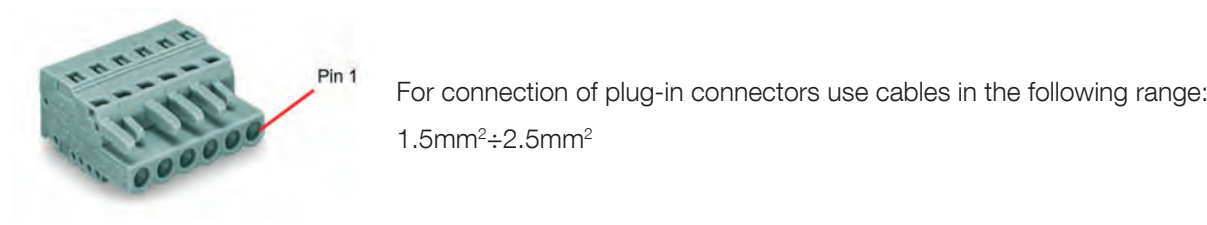
The X107 terminal is used to supply the control circuit of the C-Cab.

X108 is the output of the internal UPS. It is possible to supply the control circuits with a separated line using the X107 input.

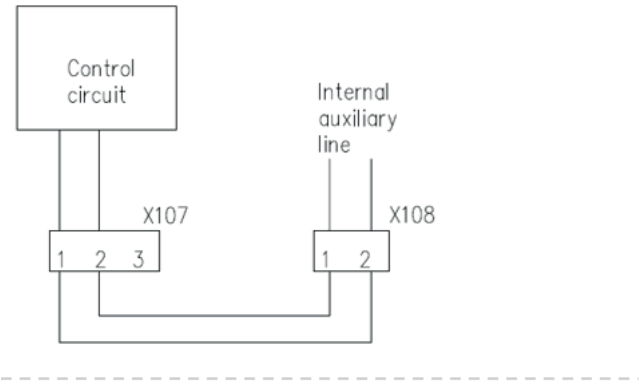
Note: none of the configurations addressed in this chapter replace the power supply connection to the X40 terminals previously described, which is always required and necessary.

Connector	Pin	Function	Description
X107	1	L	AC optional auxiliary voltage 88÷132 V 1 ph+N 50/60 Hz
	2	N	
	3		
X108	1	L	Internal UPS output 120 V 50 Hz
	2	N	
X109	1	L	Not used
	2	N	

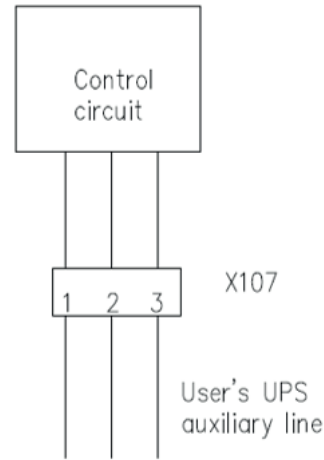
The pin 1 is the one indicated in the figure below:



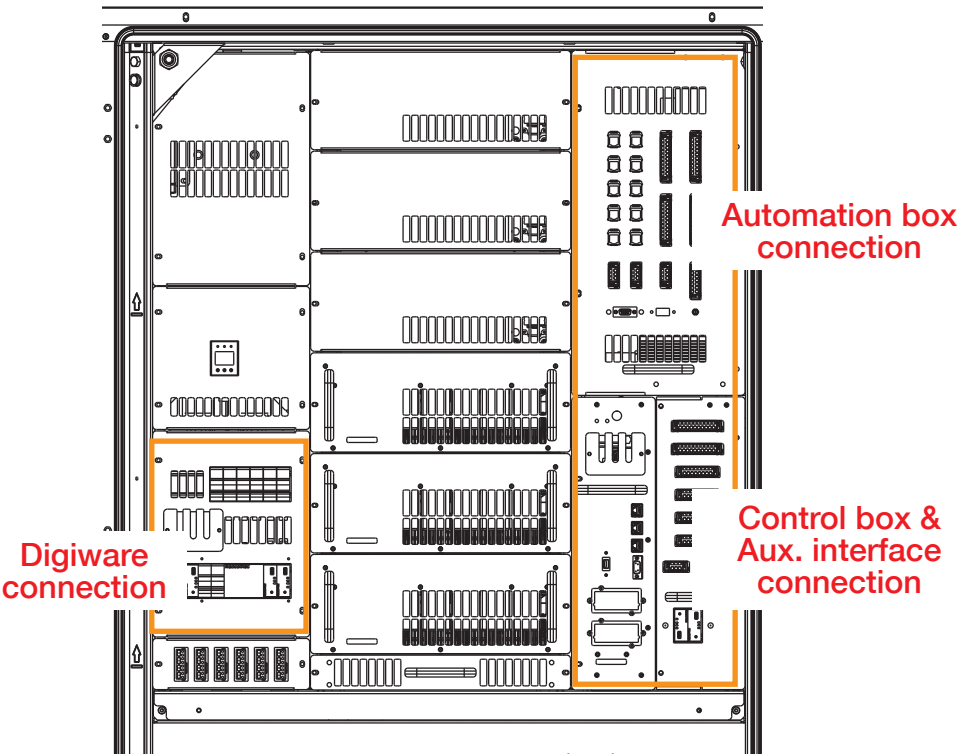
Standard configuration



Aux from user's UPS configuration



8.3.5. Communication and signal connections



Several communications and I/O ports are located on the side of the power modules.

All the connections are described in the present chapter.

Note that not all the devices described may be present, depending from the options installed (see “List of dedicated components”).

Figure 50. Location of the communication and signal connections in the C-Cab

8.3.5.1. Control Box Connections

Connector ID	Connector type	Function
ETH 1	Service only	
ETH 2	RJ45	Dedicated to user-defined functions
ETH 3	RJ45	Dedicated to user-defined functions
CAN BUS	DB-9	Reserved
USB	Service only	
SLOT 1	ADC+SL card	Not used
SLOT 2	ADC+SL card	Not used

8.3.5.2. Aux. interface box connection

X106 connector provides the Inputs and Output having the function reported in the table below.



The connections to X106 are SELV voltage.
The signal cables connected must be maintained with a proper SELV insulation.
Before using signals of this connector please contact your Socomec service team.

Connector ID	Connector type	Pin number	Function						
X106	8 pin plug-in connector	Pin 1-3	Input - Contactor force open This input forces the open procedure of the C-Cab internal contactor. It has to be connected to a normally open dry-contact. <table><tr><td>Input state</td><td>Action</td></tr><tr><td>Open</td><td>None</td></tr><tr><td>Closed</td><td>Contactor force open</td></tr></table>	Input state	Action	Open	None	Closed	Contactor force open
		Input state	Action						
		Open	None						
		Closed	Contactor force open						
Pin 2-4	Input - PO (Power Off) This input is used to switch off the power of the C-Cab using an external emergency power off button. It has to be connected to a normally close dry-contact. As standard, the system is delivered with a shunt between those pins. <table><tr><td>Input state</td><td>Action</td></tr><tr><td>Open</td><td>Power off</td></tr><tr><td>Closed</td><td>None</td></tr></table>	Input state	Action	Open	Power off	Closed	None		
Input state	Action								
Open	Power off								
Closed	None								
Pin 5-6	Internal use								
		Pin 7-8	Output - Contactor feedback This output provides the position of the internal mains AC contactor. It is an optocoupler transistor output. <table><tr><td>Contactor position</td><td>Output state</td></tr><tr><td>Open</td><td>0</td></tr><tr><td>Closed</td><td>1</td></tr></table> Maximum current: 10mA Pin 7: emitter Pin 8: collector	Contactor position	Output state	Open	0	Closed	1
Contactor position	Output state								
Open	0								
Closed	1								



For connection of plug-in connectors use cables in the following range:
1.5mm²÷2.5mm²

8.3.5.3. Connections of automation box

The Automation Box may contain different optional components as listed in the “List of dedicated components” section.

Below there is a list of the connectors present in the front of the Automation Box.

Refer to Socomec for additional details about the functions supported by the installed options.

Connector ID	Connector type	Pin number	Function	
Eth 1	RJ45		External control	
Eth 2	RJ45		PMS external	
Eth 3	RJ45		C-CAB external	
Eth 4	RJ45		Plant external	
Eth 5	RJ45		Service – SAT	
Eth 6 – Eth 9	RJ45		Free	
Eth 10	RJ45		Communication with Control Box	
X2	DB-9		CAN for B-CAB	
X3	10 pin plug-in connector	1-2	Emergency stop input 1	
		3-4	Emergency stop input 2	
		5-6	Internal use	
		7-8	Internal use	
		9-10	Internal use	
X4	10 pin plug-in connector	1-2	Emergency stop output	
		3-4	Emergency stop output	
		5-6	Emergency stop output	
		7-8	Emergency stop output	
		9-10	Emergency stop output	
X5	10 pin plug-in connector	1-2	Input IX1.1 – reserved for PMS functionalities	
		3-4	Input IX1.2 – reserved for PMS functionalities	
		5-6	Input IX1.3 – reserved for PMS functionalities	
		7-8	Input IX1.4 – reserved for PMS functionalities	
		9-10	Input IX1.5 – reserved for PMS functionalities	
X6	10 pin plug-in connector	1-2	Output QX1.0 – reserved for FSS (Battery Fire Safety System alarm report) functionalities	
		3-4	Output QX1.1 – reserved for PMS functionalities	
		5-6	Output QX1.2 – reserved for PMS functionalities	
		7-8	Output QX1.3 – reserved for PMS functionalities	
		9-10	Output QX1.4 – reserved for PMS functionalities	
X7	6 pin plug-in connector	1 - 6	Reserved	
X8	3 pin plug-in connector	1	+	RS485 bus for “Digiware package for PMS” and “Diris Aux power supply measurement”
		2	-	
		3	Shield	
X9	3 pin plug-in connector	1	+	
		2	-	
		3	Shield	
X10	3 pin plug-in connector	1	+	
		2	-	
			Shield	
USB	USB		USB port for datalogger - Service only	
Antenna	Proprietary device		Connection of antenna for “Wireless 4G modem”	



For connection of plug-in connectors use cables in the following range:
1.5mm²÷2.5mm² / 16÷12 AWG

Eth 10: C-Cab

In the C-Cab master, this port is connected to Eth 3 of Control Box; this cable is pre-installed.

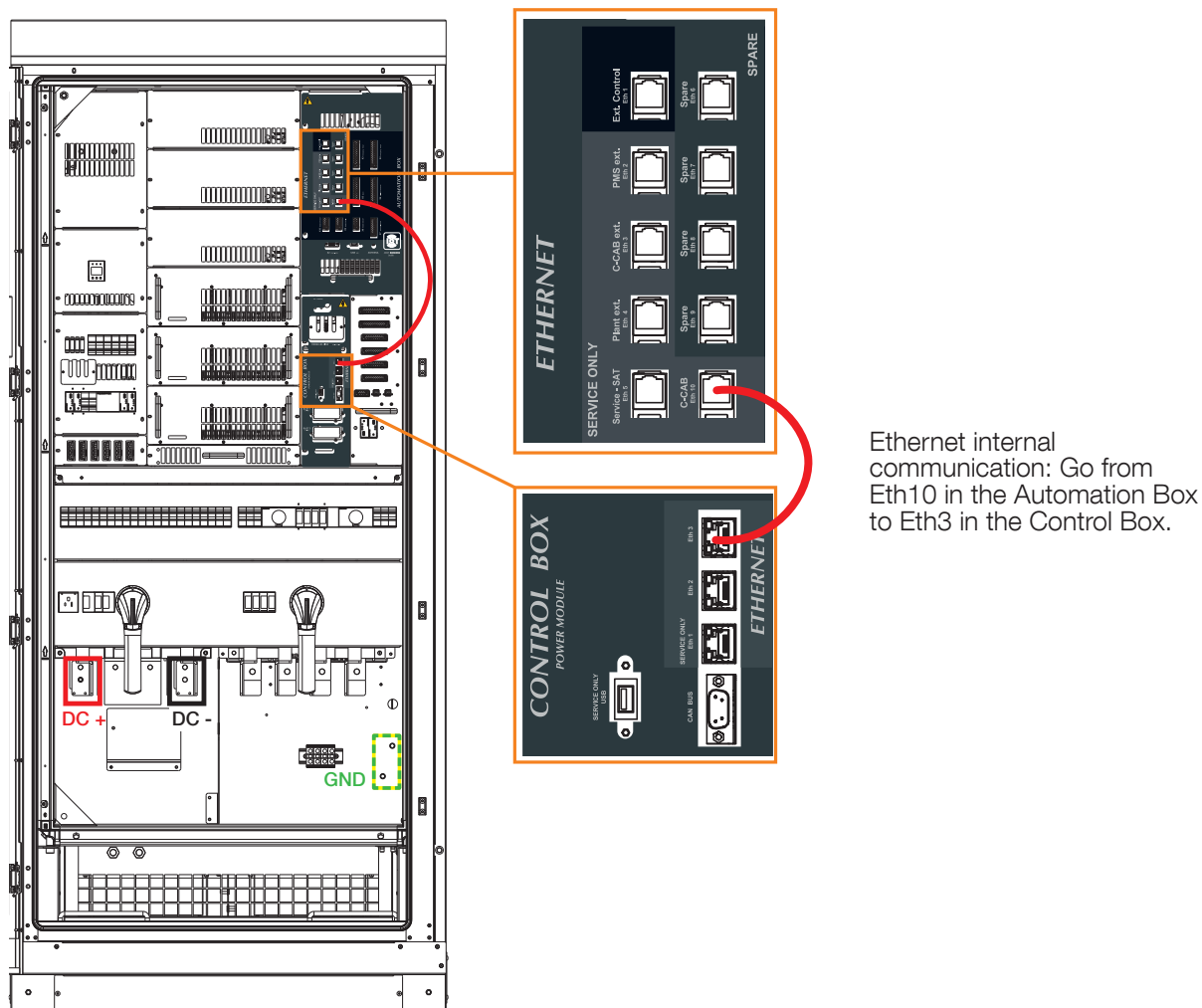


Figure 51. Connection of the communication with the control box

X2: Battery communication

The communication interconnections between the cabinets are done in a daisy chain pattern. The cable must go from X2 inside the C-Cab to JX3 of the first B-Cab. Shall there be more than 1 B-Cab, the cable will then go out of B-Cab1 through JX2 and enter B-Cab2 through JX3 and so on. When you reach the last B-Cab, JX2 is connected to the terminal resistor connector.

— Battery communication connection. On the last B-cab, JX2 is connected to the terminal resistor connector.

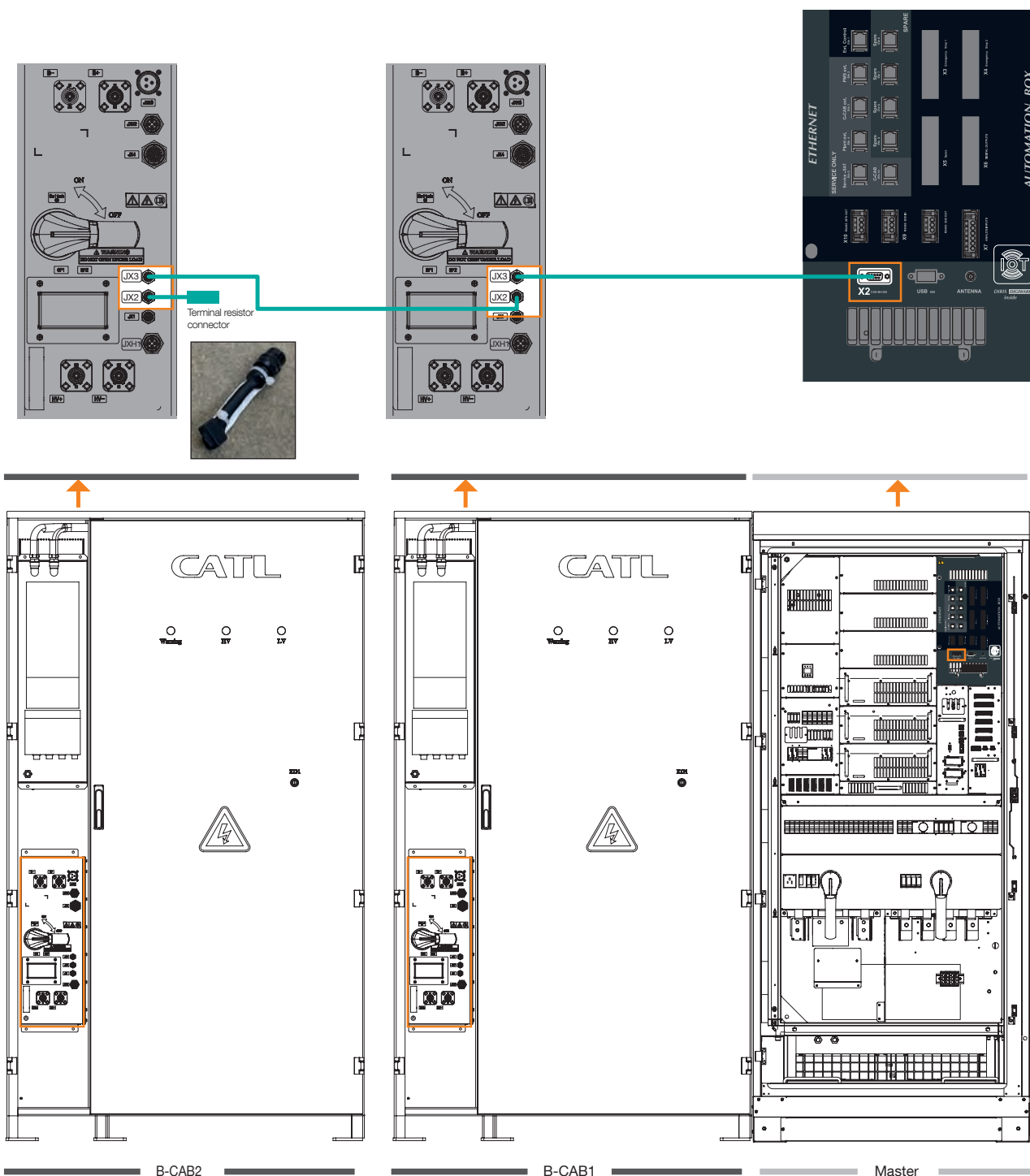


Figure 52. Connection of the communication between B-Cabs and C-Cab

X3-X4: Emergency stop input 1÷2 and Emergency stop output

These inputs are used to switch off the power of the C-Cab using an external emergency push button. Emergency stop inputs shall be connected to a normally close dry contact.

If one of the input is not used, it must be short circuited.

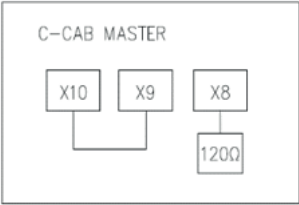
These inputs directly control the “Emergency stop outputs”.

Emergency stop input state	Emergency stop output state
Opened	Opened
Closed	Closed

The outputs can be used to switch off the power of the C-Cab and of other C-Cabs in parallel to the first one. Each output shall be connected to the EPO input of the Aux interface box (see “Connections to Aux interface box”).

X8-X9-X10:

RS485 bus used for the communication with Diris Digiware M70 and Diris B30 devices.
The cable between X9 and X10 is pre-installed. X8 is either connected to a 120Ω termination resistor when it's the latest cabinet or to a C-Cab-extension if present.



8.3.5.4. Connection to automation Digiware

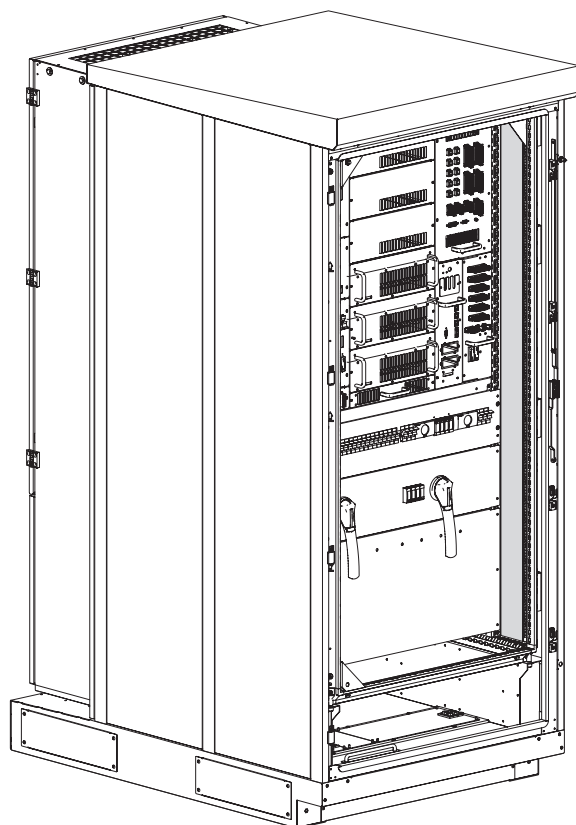
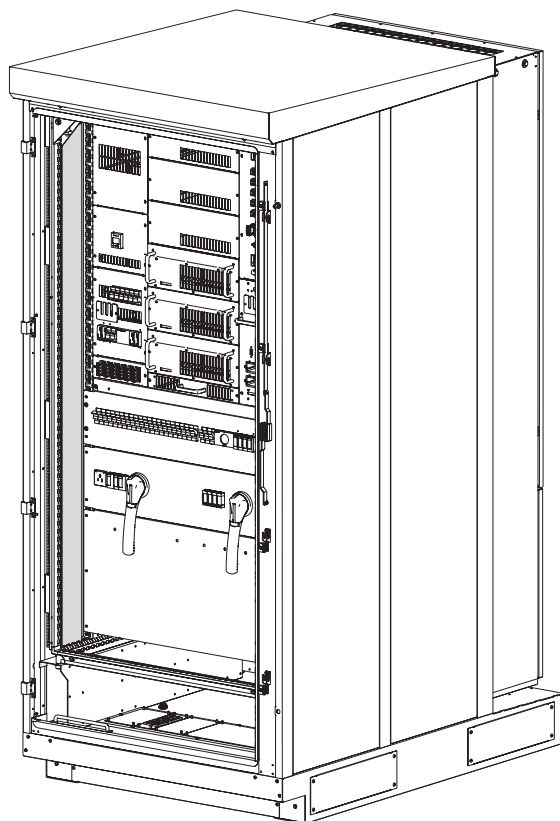
The two Diris Digiware modules are located in the left panel.

It is possible to connect other external Digiware current modules; this operation must be performed only by trained/ authorized personal.

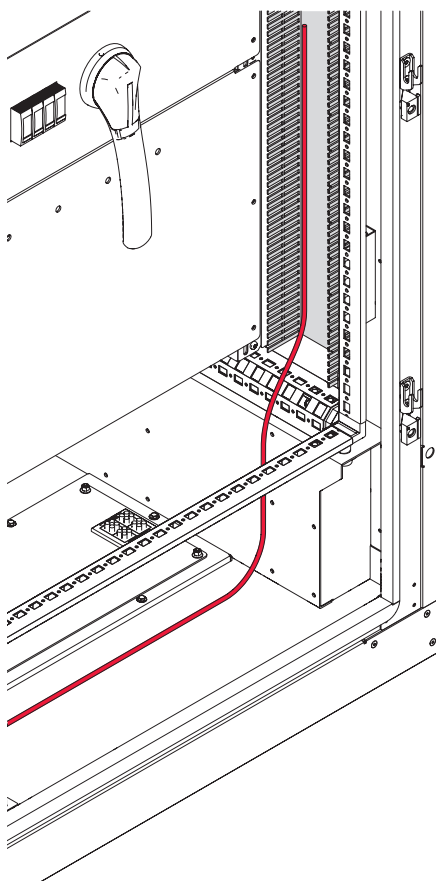
8.3.6. Connection path

The Ethernet cables need to go through the cable duct on the side wall of the machine, as per the following procedure:

- 1) Remove the cable duct cover on both sides



- 2) Pass the cables inside the cable duct
- 3) The cables shall pass under the metal covers in the lower corners
- 4) Put the cover back in place, covering all the cables inside the duct



8.4. Parallel connection

To increase the power of the system up to 3 C-Cabs (1 Master and 2 Extension) can be connected in parallel without using an additional external DC coupling cabinet.

8.4.1. DC Power Connection

When the system is composed of 2 C-Cabs (one Master and one Extension), it is mandatory to connect half of the B-Cabs to the C-Cab Master and the other half to the C-Cab Extension. If the system is composed of 3 C-Cabs (one Master and two Extension) the DC power connection will be done inside a dedicated coupling cabinet.

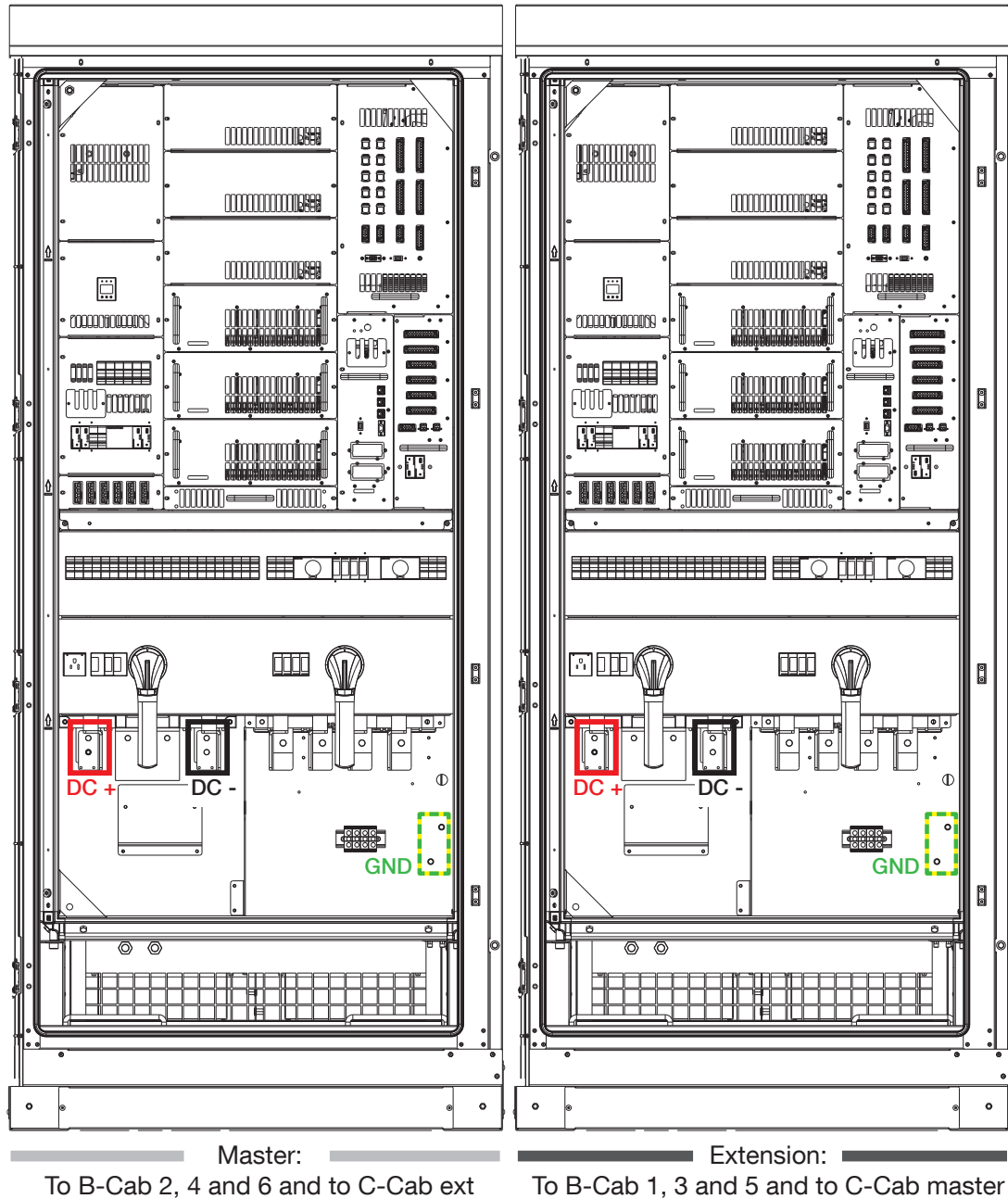


Figure 53. B-Cabs connection distribution

8.4.2. AC Power Connection

In this configuration, the connections of the parallel are made on the copper bars of the X50 terminals.

These copper bars are designed to host up to 4 cables each coming from the user's plant and up to 2 cables each going from the C-Cab Master to the C-Cab Extension in parallel (refer to the initial section of "Electrical installation" chapter for details on sizing of cables that can be connected to copper bars).

The cables from the user's plant shall be sized according to the total power of the system (C-Cab Master power + C-Cab Extension power).

All phases must be divided and connected on all C-Cabs.

8.4.3. Communication Connection

1) An RJ45 cable connects the Parallel board of C-Cab Master with the Parallel board of C-Cab Extension.

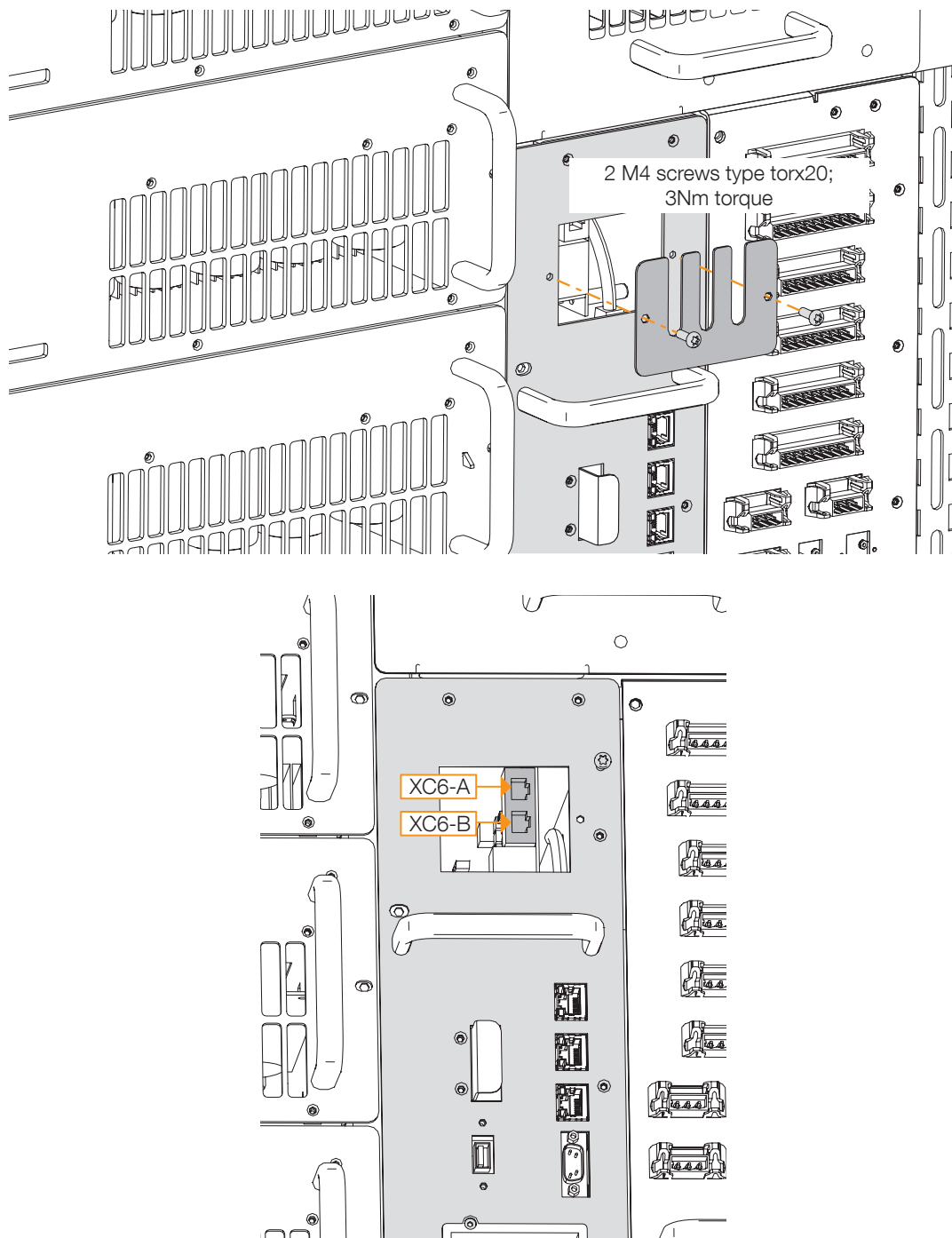


Figure 54. Location of the RJ cables for C-Cabs Master-Extension paralleling

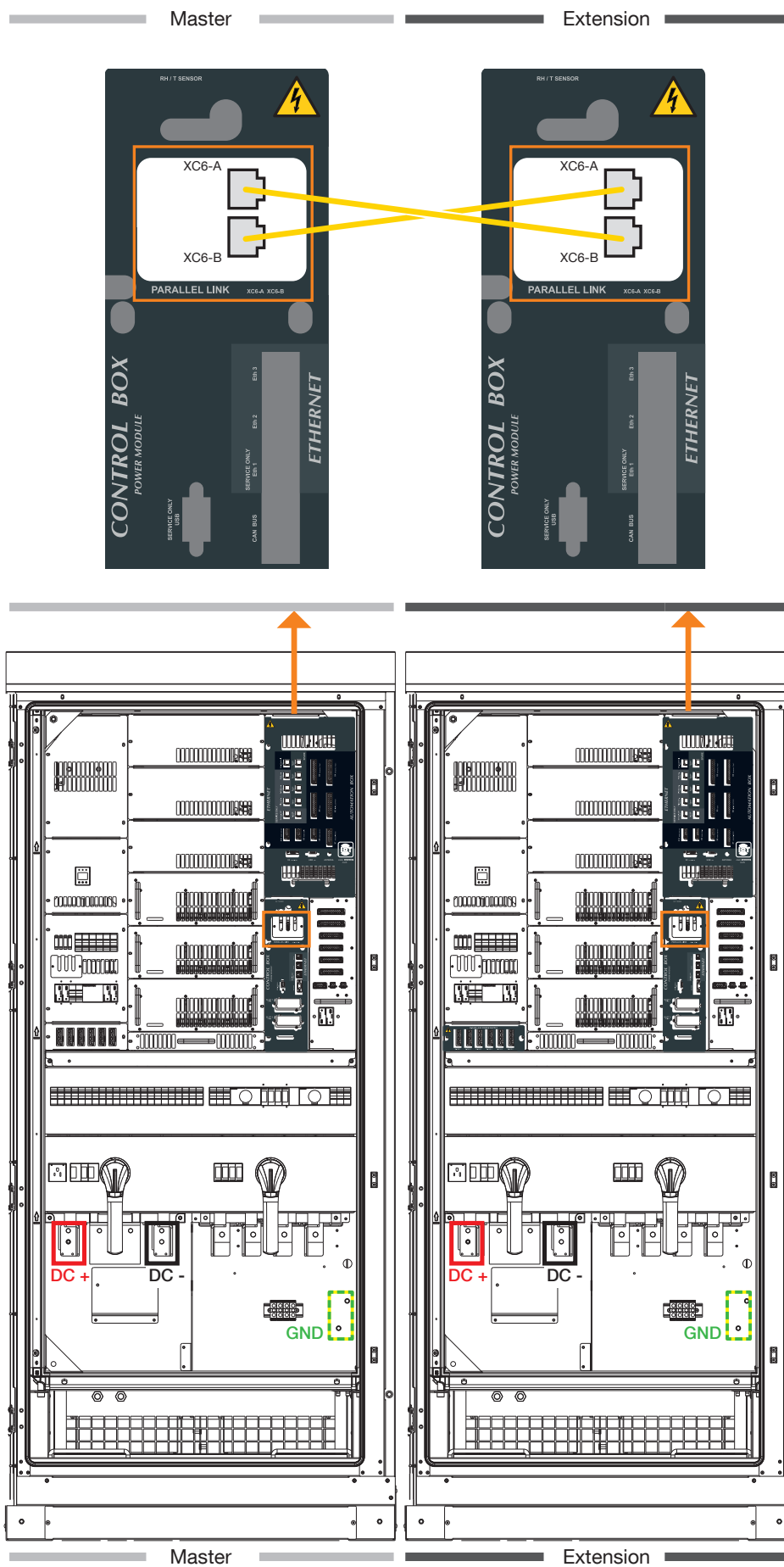
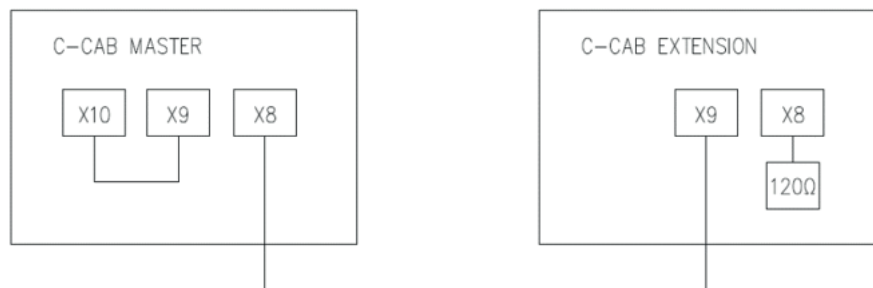


Figure 55. Connection of the communication for the paralleling

2) Parallel connection of “Digiware package for PMS”:

The cable from X8 (C-cab Master) shall be connected to the X9 connector of the C-Cab Extension.

In the C-Cab Extension, the RS485 connection must be terminated with a 120Ω resistor, (provided with the cabinet).



Control box connection: port Eth10 from the master is connected to the Eth 3 of the master Control Box, then a cable goes from Eth2 of the master Control Box to Eth3 of the extension Control Box.

— Ethernet
— RS485

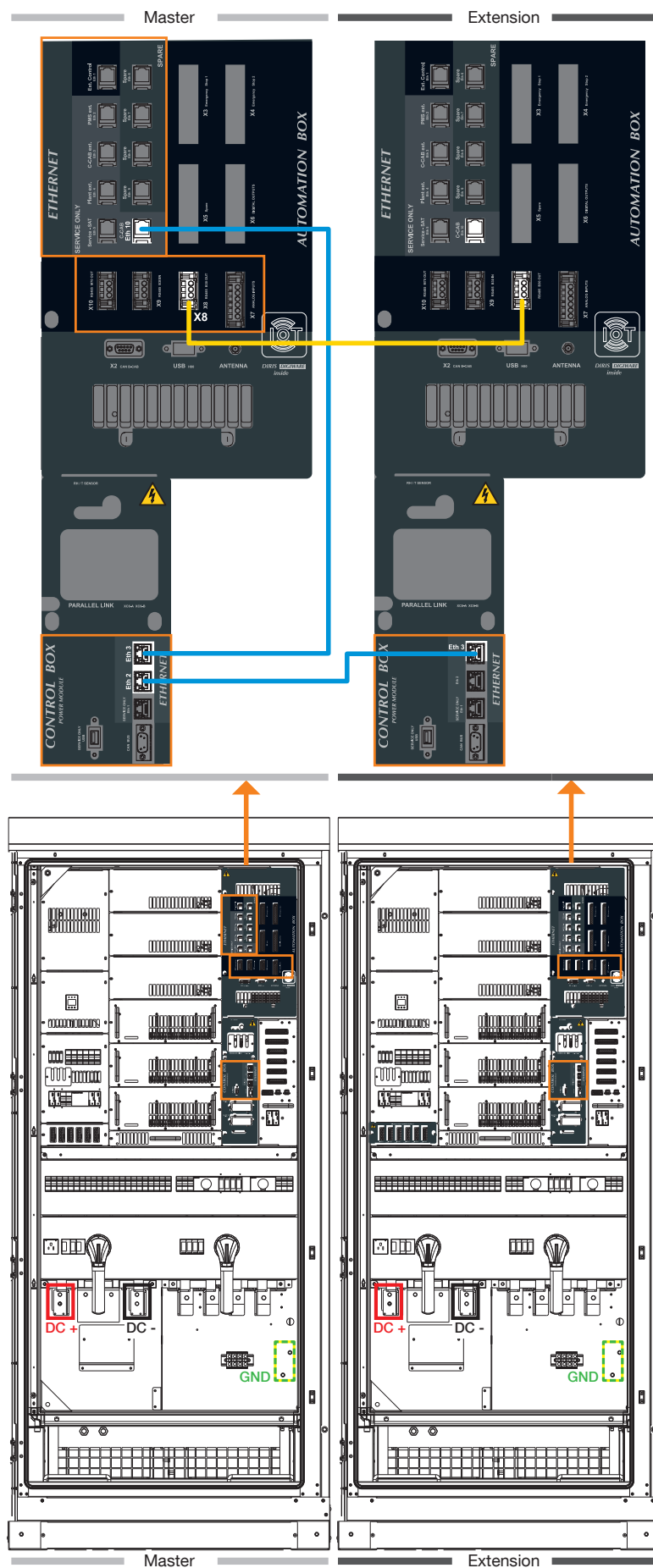


Figure 56. Figure 66 - Connection of the communication for the Digiware package

3) EPO: up to 6 Emergency Power Off outputs are available in the Automation Box of C-Cab Master.
The C-Cab Extension can be connected to the EPO input of the Aux Interface box (connector X106).

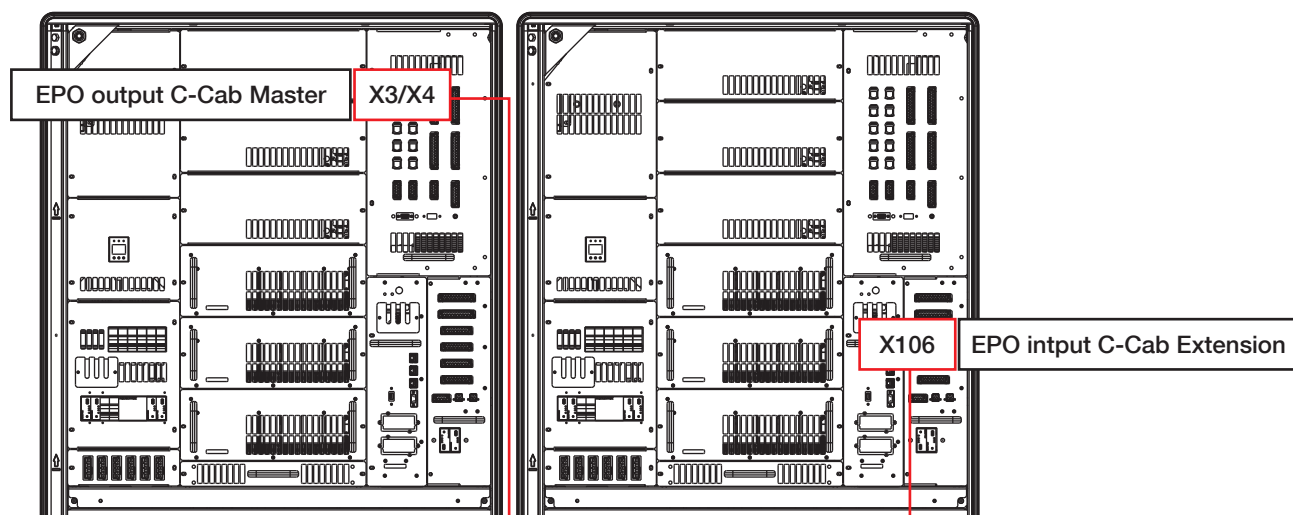


Figure 57. Location of the Emergency Power Off connections

8.5. List of fuses



CAUTION!

When replacing fuses, only use fuses of type and size indicated in the present manual.

The accessible fuses used in the unit are listed in the table below, some fuses may not be present if the related optional component is not installed in the unit (see **List of dedicated components** for more details about optional parts).

Fuse id.	q.ty	Fuse type			Function
F3	1	10x38 CC	5A	AC 230V	RCD / IMD
F4	3	10x38CC	15A	AC 230V	HVAC supply
F6	2	10x38 CC	2A	1000V DC	U-Adapter
F7	2	10x38 CC	2A	1000V DC	IMD Measure*
F9	1	10x38 CC	1A	AC 230V	PCS Opt. Digiware
F10	3	10x38 CC	25A	AC 230V	AUX Mains
F11	1	10x38 CC	2A	AC 230V	Grid contactor coil
F12	1	10x38 CC	1A	AC 230V	Control Box power supply
F17	1	10x38 CC	5A	AC 230V	Service Socket
F20A ... F20F	12	10x38 CC	25A	AC 230V	B-CAB 1 ... B-CAB 6
F21A F21B F21C	6	10x38 CC	1A	AC 230V	B-CAB 1-4 B-CAB 2-5 B-CAB 3-6
F22	1	10x38 CC	8A	AC 230V	UPS Input
F23	1	10x38 CC	2A	AC 230V	Automation box
F24	1	10x38 CC	8A	AC 230V	AUX 217V output - not used
F26	1	10x38 CC	1A	AC 230V	Hygrostat + Thermostat

* These fuses are located on the rear of the IMD device and can only be accessed by Socomec trained people.

The fuses are located in the areas indicated below:

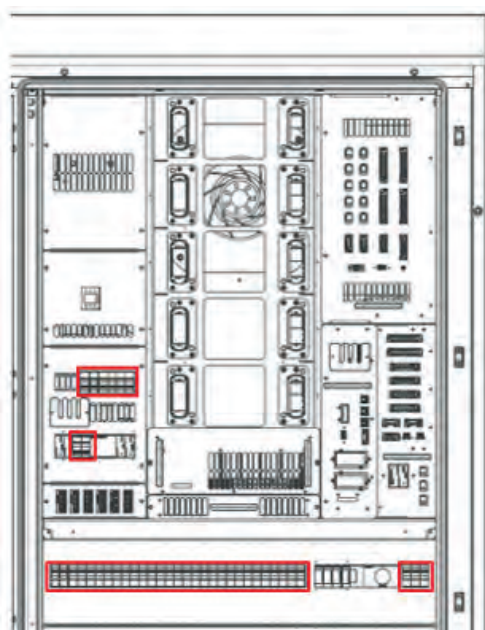


Figure 58. Location of the fuses inside the C-Cab

These fuses can only be accessed by Socomec trained personal.

Apart from the listed fuses, there are fuses to protecting the AC mains and the DC line; only trained personal from Socomec is authorized to replace these fuses.

The optional "SPD DC" are protected with a couple of fuses located under the DC input bars.

Only trained personal from Socomec is authorized to replace these fuses.

8.6. Installation of MSD

Installation of Manual Switch Disconnecter (MSD) shall be conducted by Socomec only after the installation of DC power and control cabling in all B-Cabs. Do not do it before Commissioning.

8.7. 4G Antenna Installation

Step 1: Remove the roof of the C-Cab, refer to Figures 21 and 22.

Step 2: Drill a hole in the front part of the roof - 19mm / 3/4in.

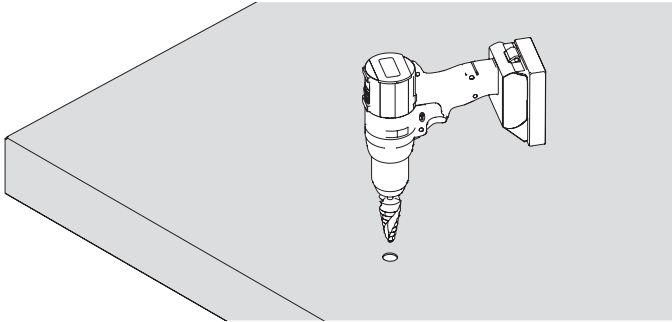


Figure 59. Hole drilling in the roof

Step 3: Install the antenna and glue it by removing the sticker, pass the cable on the right side at 310mm from the end.

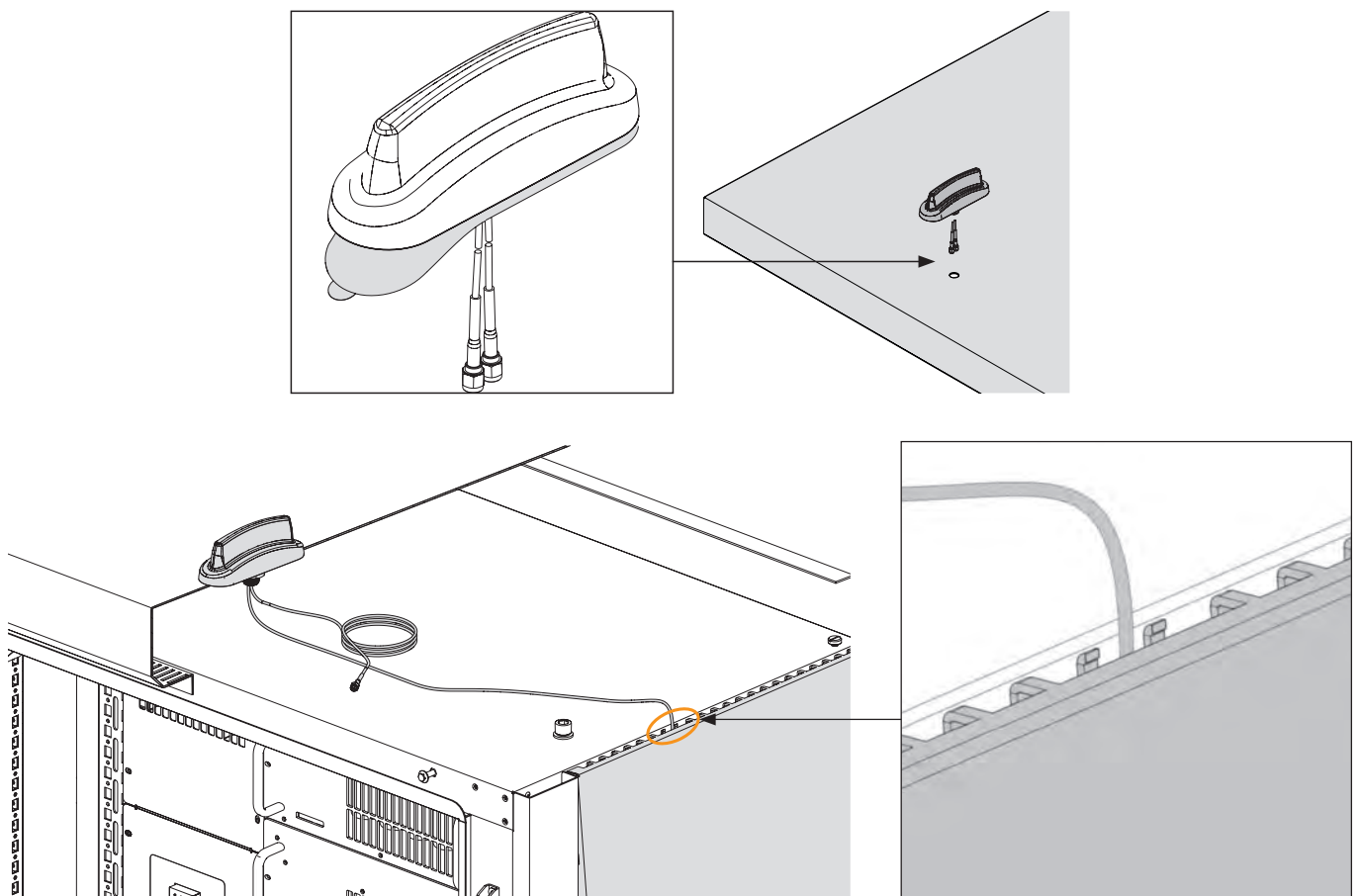


Figure 60. Antenna installation on the C-Cab

Step 4: Reinstall the cover by passing the cables inside the top hole.

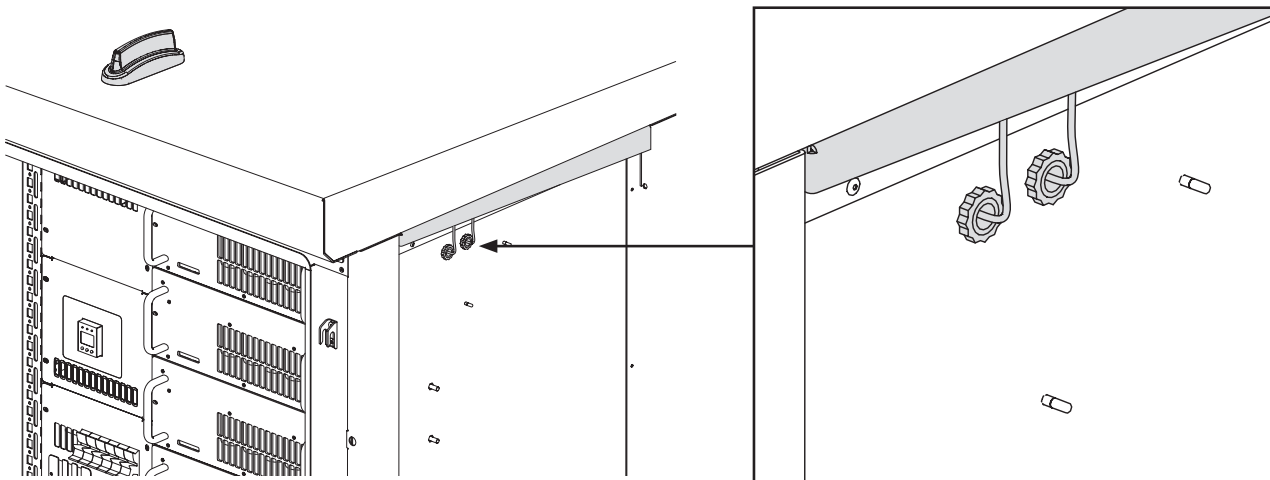


Figure 61. Cable direction from antenna to inside the C-Cab

Step 5: Connect the cables to the antenna input of the automation box : the cable marked Cellular to the connector Antenna and the cable marked Diversity to the connector Diversity.

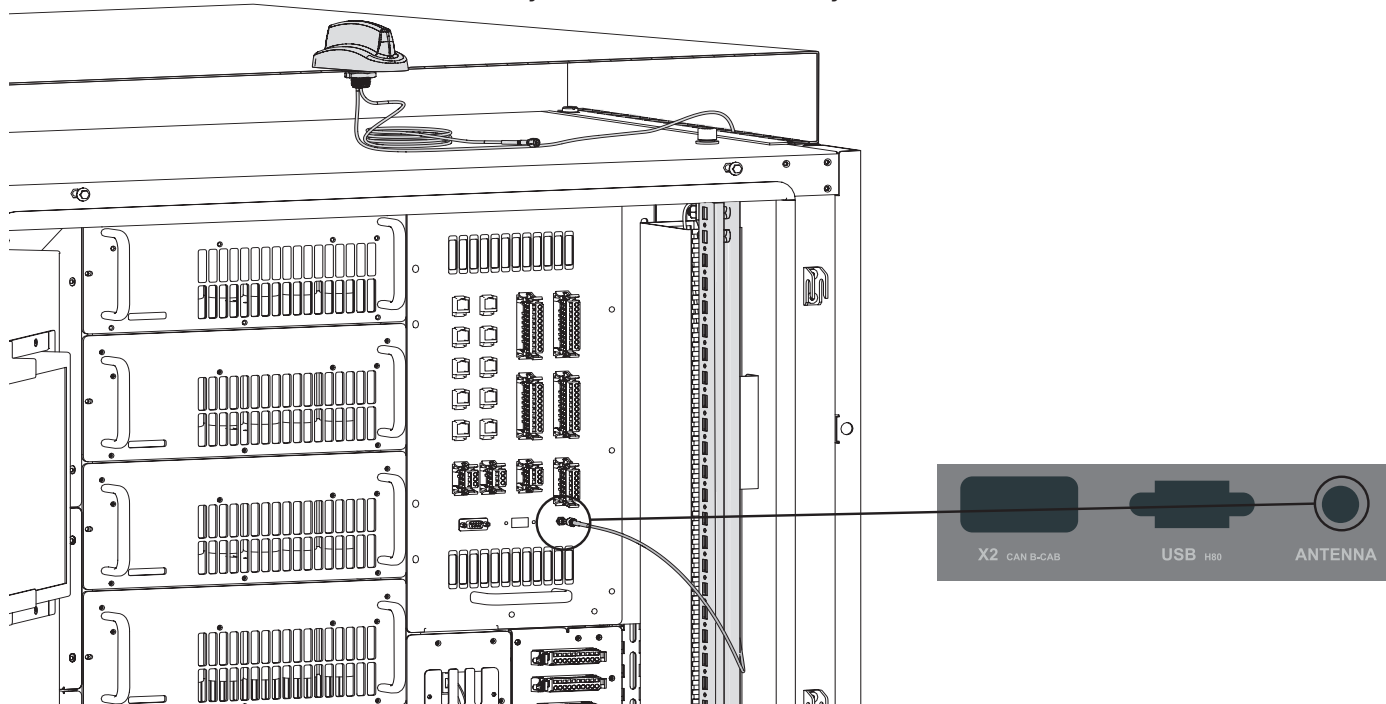


Figure 62. Connection of the antenna cable inside the C-Cab

8.8. Mounting details - end

At the end of the cabling you can proceed with the end of the installation, meaning the closure of the Cable gutters.

Step 7: Snap the B-cab connection kits covers starting from left to right and screw them with M5 nuts, torque 6Nm.

Use item 6, left cover part, for the battery at the left end – front line -, item 7, right cover part for the battery at the right end – back line - and item 4, cover part, for other batteries.

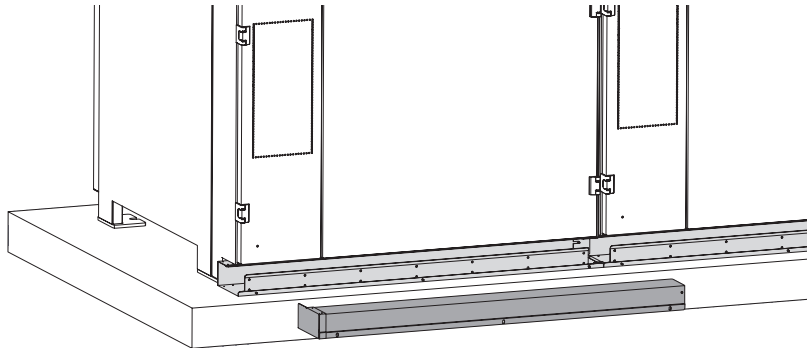
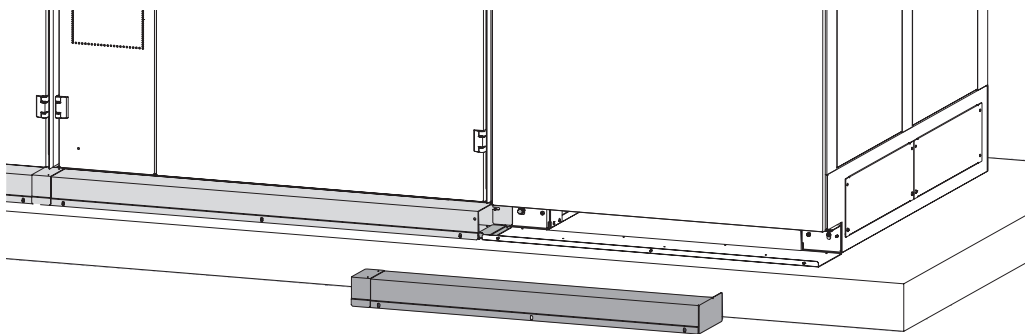


Figure 63. Screwing of the covers

Step 8: Finish with the C-Cab connection kit cover, item 2, using M5 nuts, torque 6Nm.



9. COMMISSIONING

To reduce the risk of dust/humidity infiltration prior to MHC commissioning, four stickers are covering the openings on the front and rear doors. These stickers shall not be removed prior to the commissioning. Commissioning shall be done only by Socomec trained personal, for the C-Cab configuration the “Xpertsoft” software is required.

Contact Socomec for further details.

10. HMI PRESENTATION

The status ledbar on the front of the C-Cab replicates the ledbar on the Control Box, indicating the status of the machine and the system.

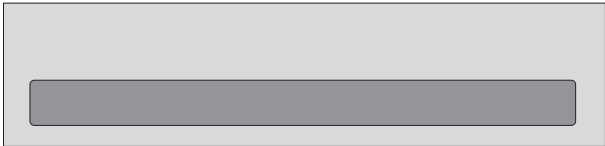


Figure 64. View of the External HMI of the C-Cab

Status bar	
Green	The system is working and turned on, no alarm and no warning present
Blinking green/yellow	The system is on and a warning is present
Yellow	The system is turned off and a warning is present
Red	Alarm present and the system is off
Nothing	System is off, with no alarms nor warnings

The LEDs on the batteries have the following functions:

LEDs	
WARNING	A warning or alarm is present on the battery
RUN	The battery is in operation
READY	Battery auxiliaries are powered on

11. PRODUCT OPERATION



WHEN WORKING IN CLOSE PROXIMITY TO LIVE INSTALLATIONS

Follow all safety requirements which includes, but not limited to, the use of protective equipment (PPE: clothing, insulated gloves, safety goggles, etc.). It is further recommended that all metal jewellery (i.e., wristbands, watch chains, rings, bracelets, necklaces, body jewellery, piercings, etc.) shall not be worn when working on electrical installation.

The procedures detailed in this section are intended as a guide to both a normal power up of the unit from a non-operating state and for an initial power up.

The equipment doors must be opened to access the breakers and switches; this is a normal operating situation. Always ensure that the dead fronts are secured in place before applying power.



WARNING!

Operate the system with all dead fronts in place; open dead front panels expose the operator to high arc flash energy risks.



WARNING!

Do not open the battery right door when the system is operating.

In this case, the battery will disconnect but the others will continue operating, thus leading to a possible unbalance between them and difficulties to reconnect the disconnected battery.

11.1. Normal system power on

1. Check the switch QS is in the ON position in each B-Cab, refer to Figure 47.
2. Switch on the auxiliary power:

Switch on Q3 by turning the handle in position 1

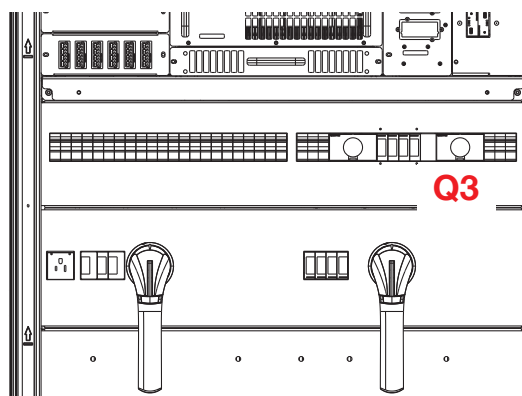


Figure 65. Location of the switch Q3 in the C-Cab

3. Switch on the UPS:

Remove the top-left panel by removing the four screws

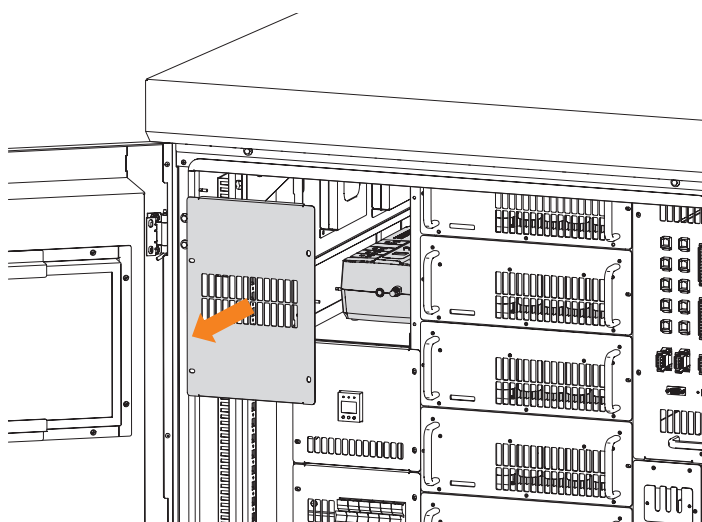


Figure 66. Location of the UPS in the C-Cab

Press and hold the button on the top of UPS for a few seconds, until device beeps

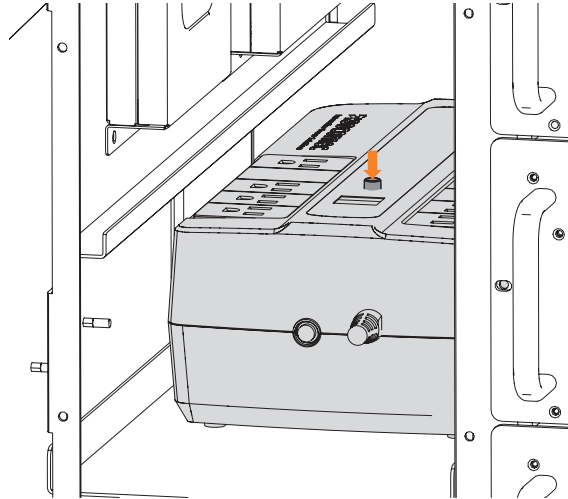


Figure 67. Location of the power button of the UPS

Close the top-left panel using the four screws previously removed

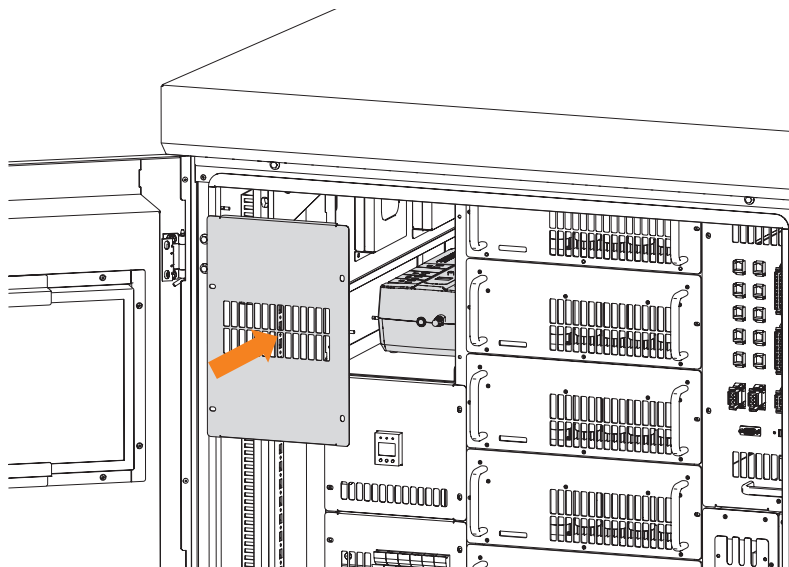


Figure 68. Reinstallation of the panel

If an external supply line (see AC aux from user's UPS.) is connected to the X107 connector, this power line has to be switched on

4. Switch on AC and DC:

Switch on Q1 (mains AC and Q2 (DC bus)) by turning the handles in position 1

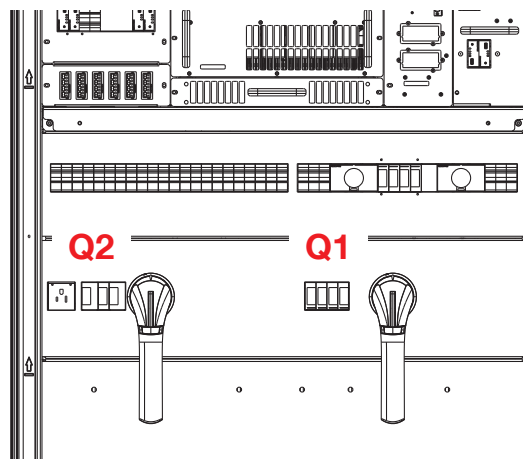


Figure 69. Location of the AC and DC switches (Q1 and Q2) in the C-Cab

Check that there are no active alarms present The system is ready.

11.2. System power off

- A. Remote System Power Off
EMS sends the power off command to PMS.
- B. Manual System Power Off (if required)

In order to manually switch off the system, follow the procedure below.

With this procedure, the load will be disconnected.

For any service requiring access to the internal components of the unit, it is necessary to power off and complete the internal isolation before the dead fronts are removed. To complete full isolation and make the unit safe for service, please wait for 5 minutes after complete power off of the unit before accessing internal components and open the control switches and breakers.

Ensure the system is in standby mode (no active dis/charge)

1. Switch off AC and DC:

Switch off Q2 (DC bus) and Q1 (mains AC) by turning the handles in position 0, refer to Figure 81.

2. Switch off the UPS:

Remove the top-left panel by removing the four screws, refer to Figure 79.

Press and hold the button on the top of UPS for a few seconds, until device beeps and the output of the UPS is switched off, refer to Figure 80.

Close the top-left panel using the four screws previously removed, refer to Figure 81.

If an external supply line (see AC aux. from user's UPS) is connected to the X107 connector, this power line must be disconnected

3. Switch off the auxiliary power:

Switch off Q3 by turning the handle in position 0, refer to Figure 78

4. Open the isolation switch QS and QF1 & QF2 in all B-Cabs, refer to Figure 47.

The unit is now isolated for service and the appropriate dead-fronts may be unscrewed and removed; however, it is very important that all accessible terminals be proven to be electrically dead before any work is attempted in the unit.

11.3. Operations

C-Cab can charge and discharge the batteries at a power level that can be specified by the operator.

- Charging mode

In the Charging mode, the power modules convert the grid AC power into DC power and charges the battery. The charging profile is managed by the SUNSYS C-Cab L Marine according to the battery needs.

After the battery is fully charged (top of the SOC range or the maximum voltage), the ESS returns into its standby mode.

- Discharging mode

The power modules reverse their operation (compared to the charging mode) and convert the DC power to AC one. The ESS stays in this mode until it receives a command to charge or go to standby mode or until the battery reaches its low end (minimum allowed SOC).

After the battery is fully discharged (minimum allowed SOC), the ESS returns into its standby mode.

- Reactive power

C-Cab can control the power factor and reactive power percentage by feeding the reactive power.

- Stable output voltage and frequency

C-Cab can stabilise the output voltage and frequency by controlling the reactive power and active power in the on-grid applications.

11.4. IMD and RCD setup

When installed, the IMD or RCD options are configured with predefined settings.

During the commissioning trained and qualified service personnel may modify the predefined settings with others, depending on the plant configuration (number of C-Cabs, B-Cabs).

No setup is required from user.

12. PRODUCT EVOLUTION

12.1. Power module insertion

	WARNING! RISK OF TIPPING OVER: before carrying out any operations, ensure the C-Cab is secured at the feet.
	WARNING! RISK OF TIPPING OVER: the modules must be inserted from the bottom upwards and removed from the top downwards to ensure the unit remains stable.
	WARNING! The modules have to be moved individually. Never handle more than one module.
	Weight of the module: 22.5kg

Procedure:

Remove the front panels unscrewing their lateral screws

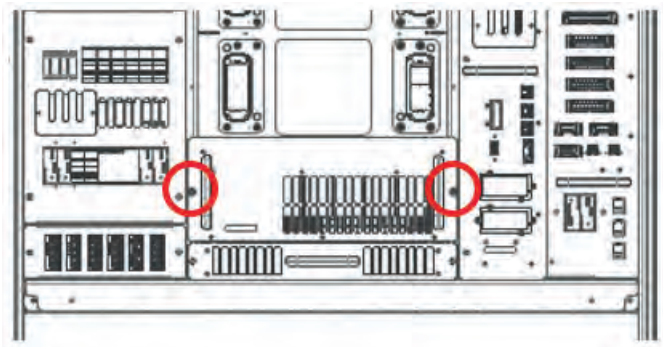


Figure 70. Power module screws location

Insert the module completely, starting from the lower one

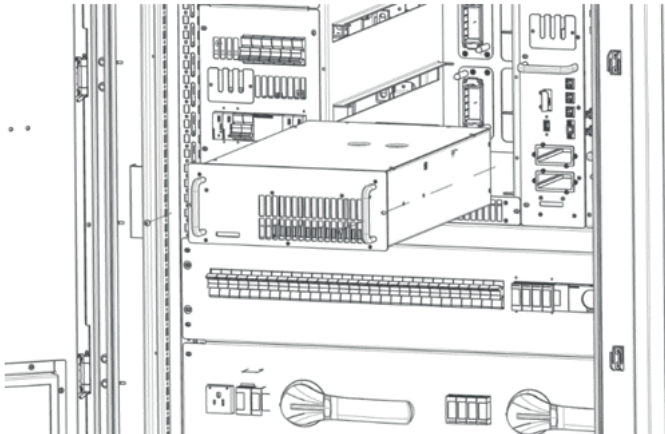


Figure 71. Insertion of the power module

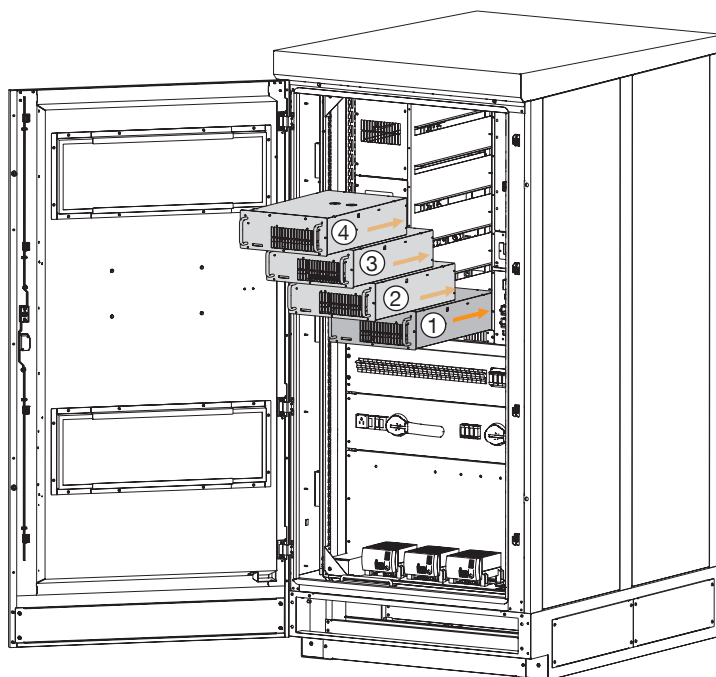


Figure 72. Order of insertion of the modules

Tighten the screws at 5.5 Nm / 3.7 ft-lbs to secure the module

13. MAINTENANCE

	CAUTION! Lethal voltages exist inside the unit during normal, maintenance and service operations. Disconnect and lock-out all power sources before working inside the unit. For your safety, it is imperative that you check, and do not assume, that all accessible terminals (not just those being contacted) are proven electrically dead (no potential between all connections or to ground).
	CAUTION! Before carrying out any operations on the unit read the “Important Safety Instructions” chapter carefully.
	CAUTION! SUNSYS specific maintenance should be performed only by Socomec trained and qualified service personnel. SUNSYS routine maintenance should be performed only by personnel trained and qualified, as per local regulations.

The SUNSYS HES L Marine will require periodic attention and maintenance in order to ensure trouble-free operation. Maintenance will be considered in the following phases:

1. Timely Inspection and Corrective Actions: Driven by automated alarms and warnings
2. Preventative Maintenance:
 - a. Routine Visits: Yearly inspections with follow up corrective actions if required and maintenance of specific components
 - b. Specific visits: regular maintenance of specific components at specified periodic intervals
3. End of life refresh maintenance

Before performing any maintenance activity, the system must be switched off and isolated following the procedure described in Manual System Power Off Chapter.



Note: The maintenance on the HVAC is not handled by SOCOMEC.

13.1. Timely inspections and corrective actions

Timely inspections and associated corrective actions are to be driven by any system generated alarms and warnings. The potential alarms and warnings are listed in the Troubleshooting part of this manual.

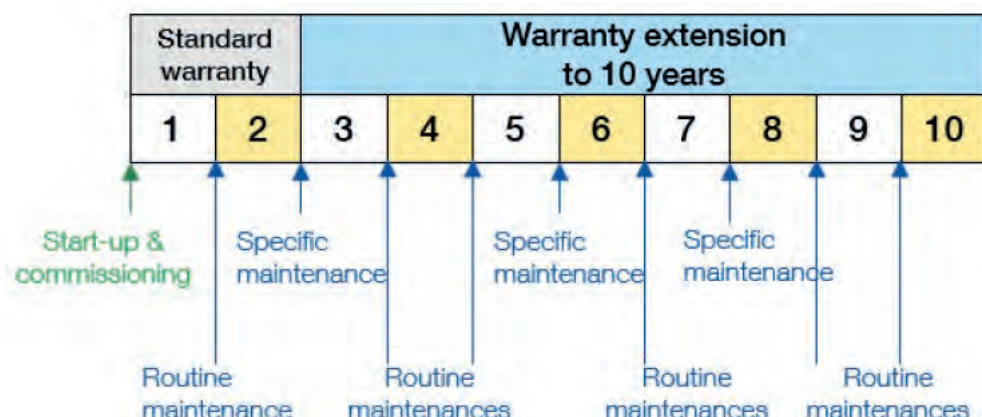
Note: The service provider is responsible for managing the timely service of the unit based on the alerts and alarms delivered from the SUNSYS HES L Marine.

13.2. Preventive maintenance

Maintenance requires accurate functionality checks of the various electronic and mechanical parts and, if necessary, the replacement of parts subject to wear and tear (filters, fans and capacitors). It is recommended (even mandatory in case of warranty extensions) to carry out annual preventative maintenance, in order to keep the equipment at the maximum level of efficiency and to avoid the installation being out of service with possible damage/risks. Maintenance consists of parts replacement as well as functionality checks on:

- Electronic and mechanical parts
- Dust removal
- Software updating (only possible by Socomecs' teams)
- Environmental checks

The following table, shows which are the routine maintenance visits, which are the specific maintenance visits, and when these visits must be performed. Depending on the level of maintenance contract chosen, the routine maintenance visits can be performed by customer and under customer's responsibility (requiring that the customer is qualified to perform such work in the local jurisdiction. Socomec requires the customer to provide a maintenance report to Socomec after each routine maintenance operation). The specific maintenance visits must always be performed by Socomec or an authorized third party.



The following inspections should be performed at the recommended intervals given in the table below:

Table of Preventative Maintenance

Schedule	Inspections/Procedure
Monthly	Operate a SOC battery calibration, refer to "SUNSYS HES B-Cab Calibration Method".
Yearly *	- Check and keep the site clear around the unit removing any foreign material that could block the intake grills. - Check all the ventilation grills are free from dirt and debris. - Check all the C-Cab filters for any dirt and debris accumulation; clean, wash or replace as required following the instructions below; the replacement must be done at least once per year. - Check the SPD functionality in the C-Cab following guides and procedures (See details below). If defective, must be replaced. - Clean the pollen from the cabinet if needed during the pollen season to prevent the mesh from being blocked. - If there are fluid leaks, or other indication that fluid levels in B-Cabs are low, then 'Topping up the cooling system' may be required (This is to be done by Socomec or 3rd party service team only). - To ensure the free circulation of air in the B-Cab, clean the system regularly as required. Especially for dusty application scenarios, it is important to clean the air inlet and outlet of the fans. Check and clean the drain on the floor drain when necessary, using a vacuum cleaner (usage of air-compressor is forbidden). - Check in all the B-Cabs for the operation of the temperature and smoke sensors as indicated by the red LED flashing every few seconds. - Clean the dust on the B-Cabs condensers. - Inspect signs of external corrosion and use a suitable paint to mitigate the spread of rust. Check for any wire distortions or colour change. Contact Socomec for additional details.
*Note: The optimal inspection frequency will depend on the operating environment; the minimum recommended inspection frequency is yearly for clean dry locations, but it is also recommended that there should be monthly inspections for the first quarter to establish an optimal inspection frequency for the specific site. More frequent inspections may be required for adverse environmental conditions (e.g., Dust, airborne contaminants, chemical fumes, etc.).	
During maintenance visits at the end of years 3, 5 and 7	Replace the UPS that is inside the SUNSYS C-Cab L Marine.
Every five years (by Socomec or trained service technician only) Note: The system is completely powered off for this inspection	- Check for signs of discoloration on all electrical power terminals which is indicative of overheating, if so clean and re-torque terminals. - Re-torque all connections including the AC & DC power connections. - Inspect signs of corrosion and use appropriate paint to mitigate the spread of rust wherever observed. B-Cab: - Drain the coolant following the procedure and replace with fresh automotive grade antifreeze (50% Glycol). - Replace the desiccant in the condenser. C-Cab: - Replace the UPS that is inside the SUNSYS C-Cab L Marine. - Replace the fans (modules and cabinets). - Replace the extractor. - Replace the Humidity/Temperature PCB. - Replace the hygostat. - Replace the DC capacitors PCB. - Replace the AC capacitors PCB. - Replace the 230Vac/24V DC Power Supply inside Automation Box.

Schedule	Inspections/Procedure
End of year 10 (not included in the maintenance contract) (by trained service technician only) Note: The system is completely powered off for this inspection	• The fire protection system in the B-Cabs requires replacement of the aerosol container. • Replace the internal converter cabinet fan (recommended). • Replace the CPU inside Automation Box. • Replace I/O and Analog cards inside Automation Box. • Replace the DIRIS. • Replace all SPDs. • Replace DC & AC capacitors PCB inside power modules. • Replace the varistors PCB (EMI filter board). • Replace the control module power supply. • Replace the RCD.

13.3. Detailed instructions – C-Cab

13.3.1. UPS

Remove the metal sheet cover, stop it by pushing for 5s the button located on top of the UPS, then unplug the UPS and plug in the new one. Then start the new one by pushing the button located on top of the UPS for 5s. Put the cover back in place, refer to Figure 79, Figure 80 and Figure 81.

13.3.2. SPD

The C-Cab is normally equipped with an SPD on AC mains and SPDs on DC input and AC aux input

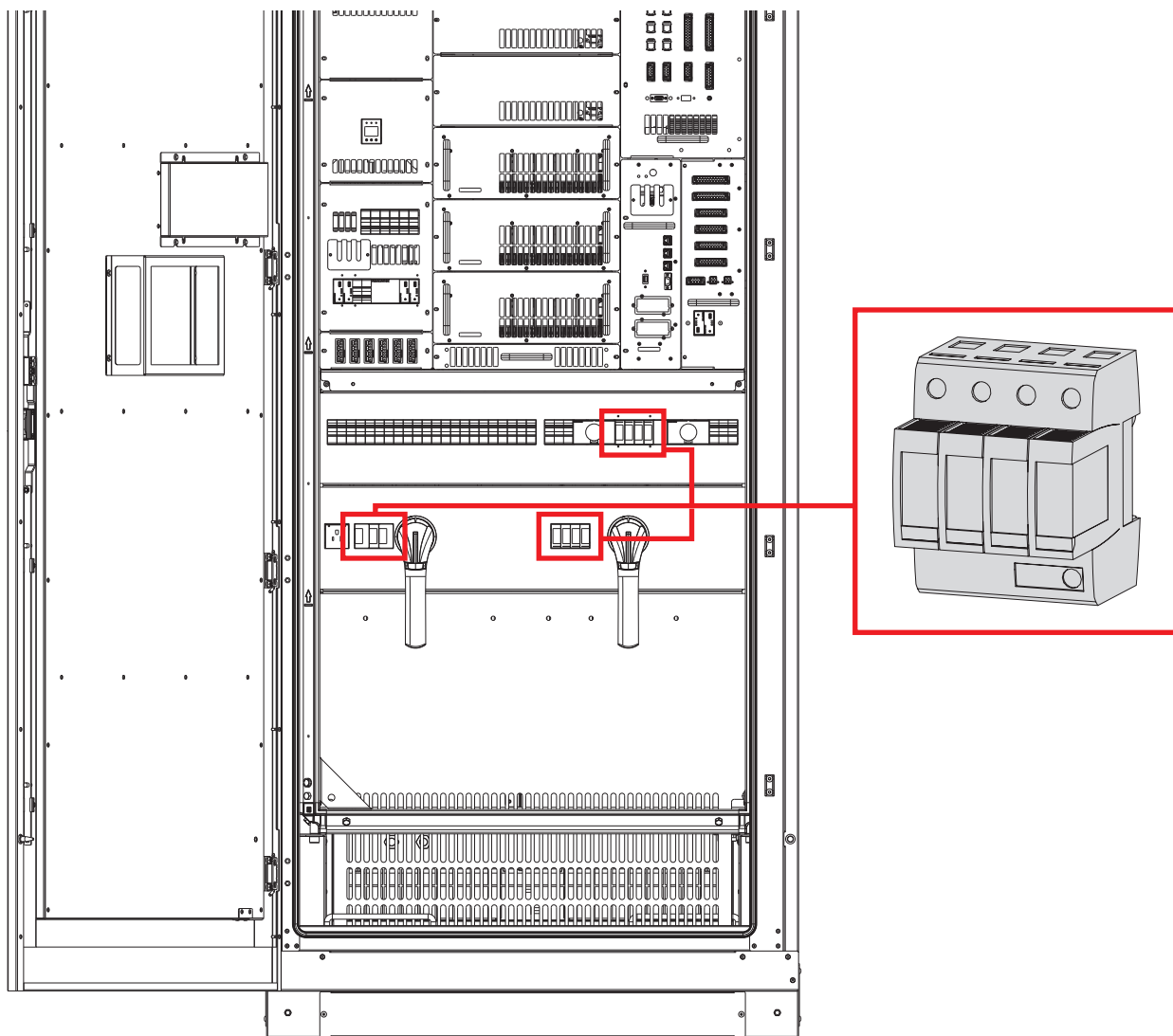


Figure 73. Location of the SPDs inside the C-Cab

Each SPD has a fault indicator; when the indicator turns red, the SPD has tripped and its module has to be replaced.

13.4. Detailed instructions – B-Cab

13.4.1. Battery unit



DANGER!

Batteries present an inherent risk of electrical shock. Contact with any part of the battery circuit battery can result in electrical shock.

Batteries are supplied in a charged condition and are capable of extremely high short circuit currents. Take care to avoid short-circuiting any terminals; use only appropriately insulated tools.

Warning: Risk of fire, explosion, or burns. Do not disassemble, heat above 60°C, or incinerate. Avoid any short circuit. Avoid any Metallic parts around the battery, do not place tools or items on top of the battery.

The following additional precautions must be observed when working on batteries:

1. Remove watches, rings, or other metal objects from your person.
2. Use insulated tools only.
3. Wear insulated gloves and electrically insulated boots.
4. Do not lay tools or metal parts on top of batteries.
5. Ensure that the battery disconnect switch is open prior to installing or maintaining the battery.
6. Do not use any type of oil, solvent, detergent, petroleum-based solvent or ammonia solution to clean the battery containers or lids. These materials will cause permanent damage to the battery container and lid and will invalidate the warranty.

Follow the suggested maintenance schedule required for batteries as described in section 13.2. For servicing of battery modules from the cabinet, contact Socomec.



WARNING!

Check to ensure environmental safety, system safety, no alarm, no fault before performing maintenance operations.

After the battery maintenance of ESS is completed, you can notify our after-sales engineer to perform data analysis for free.

The battery needs to be calibrated once a month to reset the SoC level.

Please refer to the document «Calibration Procedure» to get the process.

13.4.2. Coolant

The location of independent fluid cooling loop in the B-Cab is shown in the figure below:

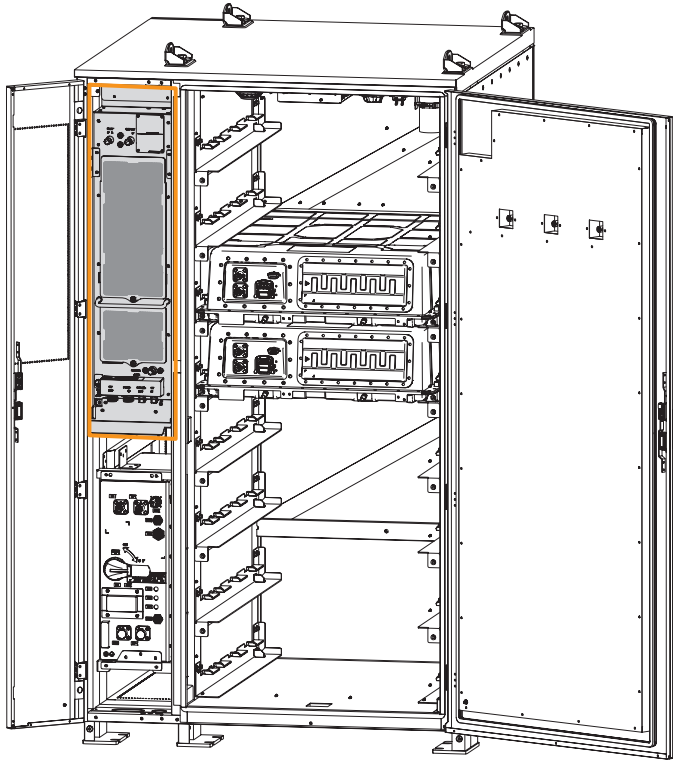


Figure 74. Location of chiller on B-Cab

Checking fluid levels

The fluid levels for batteries should be inspected and verified for the recommended levels by examining the logs of the unit. A hydrostatic level sensor is used in the system to alert when the coolant level is low. If the liquid pressure goes below the set level (< 0.8), an alarm will be prompted, and the coolant should be filled for the recommended level. In this situation, please contact your Socomec service team.

	CAUTION! This procedure should be performed only by a trained and qualified service personnel and should be carried out only when the system is de-energized at the input power source.
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13.4.3. Battery disposal and recycling

	CAUTION! Ensure the batteries are fully discharged before attempting for disposal
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To dispose of the batteries, they must be fully discharged and packaged and transported in accordance with prevailing transportation rules and regulations and disposed of in compliance with local and national laws by a licensed or certified lithium-ion battery recycler. For further assistance, contact Socomec.

13.5. Capacity measurements of the Battery System

Refer to the «Capacity Measurement Method» document.

14. TROUBLESHOOTING

The alarm messages offer immediate diagnosis of any faults, malfunctions or breakdowns in the batteries. The following events are indicated:

- Warning: abnormal condition that doesn't cause the unit stop. This can be reset automatically.
- Alarm: serious alarm conditions that cause the unit stop. These alarm conditions require a manual reset. Alarm and warnings are divided into two categories:
- System Alarms/Warnings: these alarms/warnings relate to external parts of the unit (mains power network, output line, ambient temperature...). Corrective actions are activated by the user (system installer or operator) or by the Service team.
- Unit Alarms/Warnings: these alarms/warnings relate to parts of the unit. Corrective actions are carried out by the Support Service

15. RECYCLING INFO

Do not dispose of electrical appliances with normal waste, use separate collection facilities.

Follow local council waste regulations for proper disposal arrangements to reduce the environmental impact of waste electrical and electronic equipment or contact your local government for information regarding the collection arrangements available.

If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging health and wellbeing. Depleted batteries are considered as toxic waste. When battery replacement becomes necessary, only give rundown batteries to certified and licensed waste disposal companies. In accordance with local legislation, it is prohibited to dispose of batteries together with other industrial waste or household refuse.



The crossed-out trash bin symbol is placed on this product to encourage users to recycle components and units whenever possible. Please be environmentally responsible and recycle this product through your recycling facility at the end of its lifetime.

For any questions regarding the disposal of the product, contact local distributors or retailers.

16. TECHNICAL DATA

16.1. Dimensions and weights

- C-Cab



Figure 75. C-Cab dimensions

	100 kVA	150 kVA	200 kVA
Width x Depth x Height	1000 x 1526 x 2283 mm / 39.4 x 60.1 x 89.9 inches		
Width x Depth x Height (with packaging)	1100 x 1620 x 2453 mm / 43.3 x 63.8 x 96.8 inches		
Module weight	22.5 kg / 49.6 lbs		
Cabinet weight	1195 kg 2635 lbs	1217,5 kg 2685 lbs	1240 kg 2734 lbs

• B-Cab

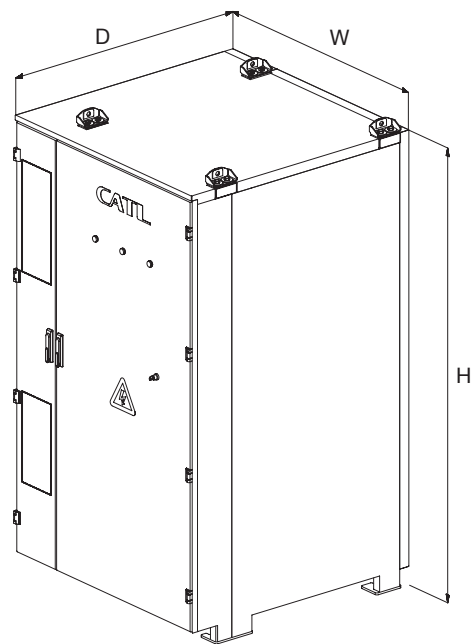


Figure 76. B-Cab dimensions

	186 kWh
Width x Depth x Height	1300 x 1300 x 2280 mm / 51.2 x 51.2 x 89.8 inches
Width x Depth x Height (with packaging)	1350 x 1350 x 2480 mm / 53.1 x 53.1 x 97.6 inches
Weight	2180 kg / 4806 lbs
Weight (with packaging)	2230 kg / 4916 lbs

The batteries are delivered with the modules already mounted.

16.2. SUN-HES-L-400

	SUN-HES-L-M-400 (Cabinet) + 1÷4 x SUN-HES-MOD50 (Power modules)		
Parameters	100 kW	150 kW	200 kW
DC Section			
Range of DC operating voltage	570÷860 Vdc		
Number of power modules	2	3	4
Maximum discharging current	174 A	260 A	347 A
Maximum charging current	165 A	248 A	331 A
Battery Section			
Li-Ion, Lead acid, Vanadium Redox, SuperCap, LIC, Electronic DC source, Generic Battery.	Supported in combination with PMS. Multi-battery compliancy through SunSpec protocol. Please contact Socomec for specific compatibility evaluation.		
AC Section			
Nominal voltage (Un)	400 Vac (3ph + N)		
Operating voltage range	400 Vac +/- 20% (3ph + N)		
Rated frequency (Fn)	50 Hz		
Operating frequency range	45 to 55 Hz		
Maximum continuous Active Power	100 kW	150 kW	200 kW
Maximum continuous Apparent Power	100 kVA	150 kVA	200 kVA
Max continuous unbalanced load (difference between max phase load and min phase load)	33.3kW	50kW	50kW
On-Grid overload	110 % - 60 minutes (Ambient temperature dependent)		
Off-grid overload (symmetrical or asymmetrical)	110 % - 60 minutes, 125 % - 20 minutes, 150 % - 60 seconds (Ambient temperature dependent)		
Rated current	144 A	217 A	289 A
Maximum temporary current (overload)	217 A	325 A	433 A
Off-grid short-circuit current symmetrical fault	300 A 50 ms	450 A 50 ms	600 A 50 ms
Off-grid short-circuit current asymmetrical fault (Phase to Neutral)	444 A 50 ms	666 A 50 ms	888 A 50 ms
Response time	<50ms, from 0 to 90% P/Q		
Output power factor rating	-1.00 to +1.00		
THDI On-grid mode	< 3%		
THDv Off-grid mode	<1.5 %		
Topology	DC/AC single conversion		
Parallel operation			
On-grid mode	With other SUNSYS C-Cab units (power extension) or any kind of third-party generator (voltage or current type)		
Off-grid mode	With other SUNSYS C-Cab units (power extension)		
	With generic current/power generators		
	Not operated in parallel with other isochronous voltage generators		
Other features			
Islanding detection	Yes		
Black start mode	Yes, capable of supplying the micro-grid from power cut conditions		
Scheduled On-grid to Off-grid mode transition	Yes, seamless transition without power supply break, with additional Socomec equipment. Please contact Socomec for further information		
Unscheduled On-grid to Off-grid mode transition	Yes, with additional Socomec equipment. Please contact Socomec for further information		
Synchronization of the micro-grid with the grid to perform Off-grid to On-grid mode transition	Yes, with additional Socomec equipment. Please contact Socomec for further information		
Integrated Power Management System services	Peak shaving, energy shifting, self-consumption, fuel saving and others on demand.		
External communication	SunSpec Ethernet Modbus TCP protocol. Alarm & warning status configurable dry contacts. Unit status light. Emergency power-off connection. Ready to connect to third-party supervision system (EMS, SCADA...).		

		SUN-HES-L-M-400 (Cabinet) + 1÷4 x SUN-HES-MOD50 (Power modules)		
Parameters		100 kW	150 kW	200 kW
Efficiency				
Max efficiency	Disch.	97.9 %	98.1 %	98.1 %
	Charg.	97.7 %	97.8 %	97.9 %
Typical efficiency	Disch.	97.5 %	97.6 %	97.7 %
	Charg.	97.2 %	97.4 %	97.5 %
Main Auxiliary Voltage				
Rated voltage		400 V 3ph+N (360÷440V)		
Rated frequency		50 Hz (45÷55Hz)		
Main Auxiliary consumption				
Max PCS control circuits consumption		76 W / 110 VA		
Consumption during operation (with HVAC working)		4.45 kW / 5.6 kVA		
Max PCS heating consumption (extreme climatic conditions)		4.65 kW / 5.3 kVA		
Temporary consumption for Drying sequence		8.75 kW / 9.9 kVA		
PCS auxiliary rated current (w/o battery racks)		8.7 A		
Max CATL battery control circuits consumption		216 W /516 VA (No. 6 racks)		
Max CATL battery heating/cooling consumption (extreme climatic conditions)		3.0 kW per rack (Max. No. 6 racks)		
PCS auxiliary rated current (with battery racks)		8.7 A + 4.3 A x No. racks		

General data	
Operating ambient temperature	-10 °C to +40 °C +40 °C to +45 °C with power derating
Storage temperature	-20 °C to +60 °C
Relative humidity	4 % to 100 % non-condensing
Cooling/heating system	HVAC (Heating, Ventilation, Air Conditioning) smart cooling/heating
Altitude	Max 1000 m, >1000m with derating (Contact Socomec team)
Pollution class in accordance with UL 840 and IEC 60664-1	Pollution class 3
Over Voltage Category (OVC) in accordance with	OVC IV
Enclosure rating	IP45 (NEMA 3R)
Environmental category	Outdoor Class C3

Certifications	
Safety	EN IEC 62909-1:2018 Bi-directional grid-connected power converters –Part 1: General requirements
	EN 62477-1:2012/A1:2017 Safety requirements for power electronic converter systems and equipment - Part 1: General
EMC	EN 61000-6-2:2019 Generic standards –Immunity for industrial environments
	EN 61000-6-4:2007; EN 61000-6-4/A1:2011 Generic standards - Emission standard for industrial environments
	ETSI EN 301 489-1 (V.2.2.0):2017 Electromagnetic Compatibility (EMC) standard for radio equipment and services Part 1: Common technical requirements
	ETSI EN 301 489-52 (V.1.1.2):2020 Electromagnetic Compatibility (EMC) standard for radio equipment and services Part 52: Specific conditions for Cellular Communication Mobile and portable (UE) radio and ancillary equipment
Grid Code	Grid code compatibility is continuously being upgraded. Please contact SOCOMEC for current grid code compatibility.
Other standards	EN 60068-2-30:2015 Environmental testing Part 2: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)

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